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A TREATISE

ON

DISEASES OF THE JOINTS.

BY

RICHARD BARWELL, F.R.C.S.

ASSISTANT SURGEON, CHARING-CROSS HOSPITAL, ETC.

Illustrated by Engravings on Wood.

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PREFACE.

NOTHING can be more useless than to apologize for publishing a book—if the work be not good enough, no excuse can improve it; and if it worthily fill a gap in the literature of its subject, an apology is unnecessary. A treatise on diseases of the joints equal to, or rather beyond, the current knowledge of the day, has long been required—my professional brethren must judge, whether the ensuing pages may supply the deficiency. No author is fit to estimate his own work at the moment of its completion, but it may be permitted me to say, that the study of joint-diseases has very much occupied my attention, even from my studentship, and that, for the last six or seven years, my devotion to that subject has been almost unremitting. Those minute investigations into the morbid actions of synovial membrane, cartilage, and bone, with which, by the publication of papers in various Quarterly and Monthly periodicals, my name is connected, were not undertaken so much from love for that sort of work as from a perception that certain links must be supplied, certain entanglements unravelled, and error, if any existed, corrected. The real weight of my work has been at the bedside, and the greatest labor devoted to interpreting symptoms, and remedying their cause. A singular circumstance, in connection with those minute investigations, cannot, however, be passed over in silence. A desire having been expressed by some members of the Pathological Society, that my specimens, showing tubes in the articular lamella, should be subject to other examination, a committee was appointed to report on them. My views, together with a Report (signed by Mr. Hulke), appear in the eleventh volume of the Society's *Transactions*. Although, in the letter-press of the latter, the tubular nature of the lamella is denied, one of the lithographs has a more dentinal look than I, fearing exaggeration, would have ventured to give. Indeed, if, as is the courteous custom of the Society, the Report had been placed before me previous to its publication, I should have ventured to suggest to Mr. Hulke, that a less markedly tubular appearance might be given to his drawing.

The subject of malignant joint-diseases has not been broached, as it appears rather to belong to a work on cancer, than to one treating only of a locality in which such a malady sometimes occurs. My best thanks are due to my colleagues, Mr. Hancock and Mr. Canton, for the kind manner in which they have placed beds in the Hospital at my disposal; even, with the greatest courtesy, have made over to my care several patients afflicted with those maladies which I was engaged in studying.

R. BARWELL.

22 Old Burlington-Street,
Dec. 1860.

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A TREATISE

ON

DISEASES OF THE JOINTS.

CHAPTER I.

PHYSIOLOGICAL ANATOMY OF THE JOINTS.

To the full and clear comprehension of the different diseases to which any organ may be subject, a perfect knowledge of its structure is the first and most necessary step; therefore it is desirable that any work which aspires to open clear views concerning its diseases, should commence by exposing the histological and physiological conditions of that part; and the more so if that author hold certain views differing from those of previous writers on the subject. The joints of the body are generally of a complicated nature, containing several different sorts of tissue, and capable therefore of several forms of the same disease; and although it is doubtless true, that with some knowledge of descriptive anatomy, and some clinical experience, any one is able to set up an empiric and coarse classification of articular diseases, yet without a clear insight into the physiology of joints it is impossible to have any very correct notions of their pathology.

The subject to which the ensuing chapters are devoted, is the pathology of movable joints, and hardly touches upon the immovable. The diarthrodial or former of these articulations is distinguished from the other not merely by its power of movement, but by the fact that in such movement one surface must glide over the other. The synarthrodial joint is not, strictly speaking, immovable, for in one of its four classes a certain amount of motion is permitted, namely, in the amphiarthrosis. This joint consists essentially in the juxtaposition (not contact) of two bones with a fibrous substance interposed, which acts simultaneously as a bond of union and a means of separation. The motion whereof this joint is capable, is permitted by the flexibility of the fibro-cartilage, not by any distinct movement of one part over another.

To our idea of a diarthrodial joint is necessary that at least two pieces of cartilage should be interposed between the bones of the articulation; each piece of cartilage lining the end of each bone, and being not continuous, but in contact with the other. The gliding movement must take place between these cartilaginous surfaces, kept moist by a secreting membrane, which closes in the cavity of the joint. The essential constituents, then, of a diarthrodial joint are:—

1st. The bones, which are jointed together.
2d. The cartilage, which lines the ends of these bones.
3d. The synovial membrane.

But besides these are:—

4thly. Ligaments binding the bones together.
5thly. Frequently an interarticular fibro-cartilage.

The bones which enter into the formation of a joint may be two or more. In the scapulo-humeral articulation is an instance of two bones jointed together; in the elbow of three, but two of these only are essential to the joint as a hinge, the other being added for purposes of its own (if it may be so expressed). In the ankle are three bones essential to the joint, two forming a socket, into which the head of the third is received. The hip-joint is composed in early life of four bones, but later it abrogates this peculiarity, the three which formed the socket becoming united into one. The shape of the articulating surfaces of the bones determines the species and form of the joint; descriptive anatomy divides them into four classes:—

1st. Arthrodia, or flat joint.
2d. Enarthrosis, or ball-and-socket joint.
3d. Ginglymus, or hinge joint.
4th. Diarthrosis, or pivot joint.

The different species of movement which these forms of articulation permit, have been the subject of more or less elaborate treatises, but the shape of the joint surface has no influence on the action of its diseases.

The bones of the joint may be either long, flat, or irregular, disposed together in any possible commutation; the larger and more important ones have, besides their other centre or centres of ossification, one for each joint extremity. The humerus, radius, femur, tibia, &c., have all this separation into diaphysis or shaft and epiphyses or joint extremities. The clavicle has but one epiphysis at the only end, which forms a diarthrodial joint, the proximal. The metacarpal and metatarsal bones have also but one epiphysis, which is in some instances at the proximal, in others at the distant extremity. The shaft of the bone begins to be ossified long before the epiphysis; about the sixth week of fœtal life is the earliest bony deposit; it takes place in the femur, and at the ninth month most of the larger bones have made considerable progress towards the formation of an osseous shaft; but the epiphyses remain cartilaginous for weeks, even months, after birth.

It is not necessary to give here an account of the ossifying process in cartilage, nor is it my desire to append an unnecessary and therefore pedantic description of bone tissue; but, in order that the pathology of certain joint diseases may be regarded from the same point of sight as is taken in this work, it is desirable that the author's views of osseous structure should be clearly expounded. Bone is generally described as a compound of cartilage and phosphate of lime, plentifully supplied with vessels, among which a large number of branched cells are arranged in a more or less definite order. Let us describe the structure in the same language differently placed, and say: Bone consists of a number of branched cells, whose interstices (intercellular spaces) are occupied by a compound of cartilage and phosphate of lime, and among which vessels pass in a certain definite relation. By adopting this method of description the different elements of which bone is composed are reduced to their proper relation—first the cells, then the intercellular substance, and then the vascular supply. The cells of the bone are contained in the lacunæ,[1] the cell walls line the spaces, and the nuclei may be seen within them. Messrs. Tomes and Campbell de Morgan state that they "have had no difficulty in finding the nuclei in recent bone without the aid of chemical treatment. If a small fragment be taken from the spongy portion of a fresh bone, and freed from adherent fat, the nuclei may be seen as small rounded bodies attached to the walls of the lacunæ."[1] Other observers, quoted by the above-named authorities, also believe in the persistence of the nuclei; viz., Goodsir, Schwann, Krause, Kohlrausch, Heischmann, Günther, and Donders. I possess many specimens, in which the nuclei are very evident. The lacunæ, and the cells contained in them, have not mere even, round, or oval walls, but branch out into a great number of fine processes, called by Todd and Bowman canaliculi; they are actual spaces in the hard tissue, containing a membranous matter, but whether the membrane itself be actually tubular is, to my mind, extremely doubtful. I am rather inclined to regard them simply as bundles of minute fibres; this structure would have the same effect on the transmission of fluids. A section through the dense structure of a long bone, the humerus, for instance, shows the following arrangement of parts. The whole mass of the bone is disposed round an axis, so that the section is ring-shaped: in the outer and inner edge of the section the disposition will be shortly described. Between these two parts the cells are seen usually to surround certain vessels in canals called Haversian, that run for the most part parallel with the axis of the bone—the whole arrangement, canal and surrounding cells, is called an Haversian system; certain parts which fill up the interstices between these circles are named by Kölliker (*Mikrospische Anatomie*, p. 292) Interstitial Laminæ; by Queckett they are more happily termed "Haversian Interspaces" (Histological Catalogue of the Museum of the College of Surgeons). In the inner and outer layer of bone, or Circumferential Laminæ, the cells are arranged round the axis of the bone; most of them are of the ordinary size and shape of the lacunæ in the Haversian systems; but there are among them certain longer cells, some of which run round the bone,[2] others, seen on longitudinal section, parallel to the axis; thus there are in the layer next the medullary cavity, and next the periosteum, two sets of long cells, which run at right angles to each other. I believe these are intended for the rapid absorption and disintegration of both these strata.

---

[1] Called, by their discoverer Purkinje, bone-corpuscles.

Some bones, the irregular ones, as those for instance of the carpus and tarsus, have no hard solid portion, but are composed of spongy texture; the long bones even terminate at their joint end or ends in a spongy portion; this in most of such bones, and certainly in all the larger ones, is formed from the epiphysis. Mr. Toynbee has made careful investigations into the ossification of epiphysal ends. The following account of the formation of vessels, to which act he chiefly directed his attention, is abridged from his admirable paper.[1] The first step is vascularization of the cartilage, which takes place by penetration of vessels into the epiphysal end from the side; indeed it is important to observe that the vessels do not approach within a line or two, either end of the epiphysal cartilage (that towards the joint, nor that towards the shaft). The vessels once formed ramify freely throughout the cartilage; towards the further or joint end they form large loops more dilated than elsewhere. After this vascularity has continued for some time, bony matter begins to be deposited about the centre of the mass; thence spreading outwards in all directions reaches the sides, but stops short at either end, only just covering in the vessels and leaving a line of cartilage on the one hand between itself and the shaft of the bone, on the other between itself and the joint. The latter is the articular cartilage, of which more hereafter; the former is the epiphysal junction. The value of this arrangement of an epiphysis or additional bone between the shaft and the joint is to permit growth of the bone in length, an object which is accomplished almost entirely by addition to the shaft ends. Hence the epiphyses remain unjoined by osseous matter until the full growth of the particular bone shall have been attained, and this is later in some bones than in others; thus the epiphysal bones of the upper extremity usually become united about the sixteenth to the eighteenth year, those in the lower somewhat later; the junction at the distal extremity of the femur is the latest; it is seldom entirely closed in the male before the twenty-second year.[2] In one case that fell under my notice, a line of distinct cartilage remained a little after the twenty-fourth year; the subject of this observation was strumous, but not rickety. The reason that this epiphysis should remain longer unossified than any other in the body, appears to be that the stature to which the individual will attain depends in a great degree upon the length of the femur; and the upper epiphysis is very oblique, almost perpendicular; hence the whole bone can only grow at that end by the little that may be added to the length of the neck, and even this will be in an oblique direction: it therefore follows, that the femur must grow chiefly from the lower epiphysis. It seems also, that those epiphyses are longest in uniting from which and not towards which the nutrient artery of the bone is directed.

---

[1] Observations on the Structure and Development of Bone. Philosophical Transactions, 1853, p. 117.

[2] Messrs. Tomes and De Morgan "On the Development and Structure of Bone;" Philosophical Transactions, 1853.

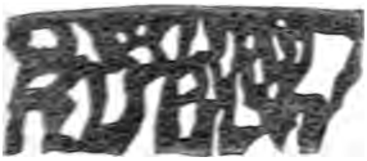
---

[1] "On the Organization and Nutrition of Non-Vascular Animal Tissues." Philosophical Transactions, 1841, p. 165.

[2] Humphreys "On the Skeleton."

When the epiphysal cartilage has become fully ossified, and long before it is united to the shaft, it assumes the form of a spongy bone, which in its physiological anatomy is in all ways comparable to the bones of the carpus, tarsus, or other such structures. Such a bone does not consist simply of solid osseous structure like that of the shaft, but of thin osseous plates, which inclose cavities. The size of the cavities, called cancelli, the length and thickness of the plates, are very variable; the cavities are from $\frac{10}{100}$ to $\frac{30}{100}$ of a line in length and breadth; the plates about $\frac{3}{100}$ of a line in thickness. Each cancellus is surrounded almost entirely by bony matter, only possessing small intervals of communication, through which vessels pass: it occupies the place, as far as nutrition is concerned, of a Haversian system; the plates of the bone being arranged around them like Haversian interspaces before they are thinned by the pressure of newly-formed and growing systems; where several lamellæ unite together, or rather perhaps where several spring from a common centre, they form a thicker triangular or quadrilateral mass of solid bone. The lamellæ are not usually traversed by Haversian canals; but occasionally, where there is a thicker and larger lamella, and sometimes when a vessel passes from one cancellus to another, there is a regular Haversian canal with concentric laminæ and lacunæ. The outer cortex of a spongy bone or epiphysis is very thin, and the lacunal arrangement is in general heterogeneous, except where a vessel, passing to the interior, forms a Haversian canal and concentric laminæ. The plates inclosing the cancelli appear to be placed in an arbitrary and irregular manner, but a little attention will show that there is a certain definite plan of arrangement, which

Fig. 1.



Cancelli and articular lamella from lower end of human tibia, magnified about 10 diameters.

is the more observable when similar sections from a number of like bones in a dry state are examined: it will then be seen how remarkably similar is the plan of architecture in all. The arrangement is such as to give the greatest amount of support to the thin outer cortex of bone, particularly to that which is towards the joint; hence there is a tendency to the formation of triangles, arches, buttresses, &c., which in some parts, as the upper end of the femur, is very perceptible and beautiful.

The measurements of the different parts above spoken of may be given as below. The lacunæ in the solid laminated bone, such as are placed round each Haversian canal, are more elongated than those in the Haversian interspaces, or in the plates of spongy bone, and are in transverse section considerably smaller, so that we have several sets of measurement:—

Transverse..	Lacunæ of Haversian Systems and ordinary Lacunæ of Circumferential Laminæ	$\frac{1}{120}$ to $\frac{1}{160}$ line in length, quite narrow.
	Cells of Haversian Interspaces . .	$\frac{1}{100}$ line in length. $\frac{1}{200}$ to $\frac{1}{150}$ line in breadth.
	Long cells of Circumferential Laminæ	$\frac{1}{60}$ to $\frac{1}{45}$ line in length.
Longitudinal.	Oval cells of compact bone . . .	$\frac{1}{100}$ line in length. $\frac{1}{400}$ line in breadth.
	Round (rare)	$\frac{1}{300}$ line in diameter.
Spongy Texture.	Oval cells	$\frac{1}{80}$ line in length by $\frac{1}{300}$ in breadth.
	Round ditto	$\frac{1}{250}$ line in diameter.
Haversian Canals (round)[1]		from $\frac{2}{100}$ to $\frac{3}{100}$ line diameter.
Round Haversian System		$\frac{8}{100}$ to $\frac{11}{100}$ line diameter.
Cancellus		from $\frac{10}{100}$ of line to $\frac{30}{100}$ line.

Each cancellus is lined by a fine membrane supporting vessels analogous to, and, when the epiphysis is united to the shaft, continuous with the medullary membrane; one and the same membrane ramifies throughout all the cancelli, being continuous with itself. The substance which fills the cavities and their membranous lining is medulla, which is of somewhat different appearance and structure at different ages, but is the same whether in cancellous cavities or medullary tube. In the young subject, and when first formed, it is pink or even red, and very soft; it becomes subsequently yellow, and comparatively firm. In the former case it is made up of fat vesicles placed close together, crowded among which, and thus forming perhaps as large a proportion of the tissue, is a mass of nucleated cells of great beauty and clearness, the size of white blood-cells, *i. e.*, about $\frac{1}{350}$ line in diameter; later in life the cells greatly decrease in quantity, and after maturity the medulla appears only to consist of fat vesicles.

---

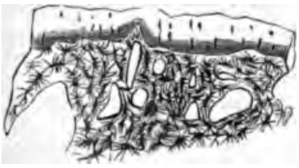
[1] Generally these parts appear oval. I have taken no measurement of their long axis under such condition, for since they are channels it follows that the long axis depends entirely on the obliquity of the section: the same may be said of the next item.

The dimensions of the cancelli, as seen on section, must naturally very much depend upon the direction in which they are cut, since, as they intercommunicate, many of them may be regarded as channels, and may have indefinite long axes. Immediately under that coating of bone next the articular cartilage, known as the articular lamella, the cavities are as a rule smaller, and the inclosing plates thicker.

The crust of bone which incloses the spongy structure towards the outside has been described as containing natural lacunæ and canaliculi, but that which is towards the joint is of different structure, and has been called articular lamella.

By cutting or scraping away the cartilage, and sawing perpendicular segments out of the bone and grinding them, thin sections of this substance may be made without much difficulty. It will then be seen that the articular lamella is lighter in color, *i. e.*, more transparent than the rest of the bone; in it bone-cells and canaliculi are absent, but there are several black opaque spots of an oblong form, with the long axis at right angles to the lamella, and two or three of these arrange themselves at a certain distance from each other in interrupted rows having the same direction. The lamella is a little darker, a little more brown, like ordinary bone, near its attached than its free surface; it looks as though at this part it had been stained. In no instance does the lamella lie immediately over, and never shuts in, a cancellous cavity; on the contrary, ordinary bone-structure always intervenes between such cavity and the lamella. In places the osseous tissue, surrounding a cavity near the margin of the lamella, encroaches thereon very much; in other places, where the cavity is deeper from the surface,

Fig. 2.

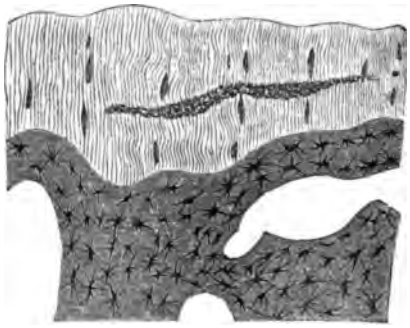


Cancelli and articular lamella from lower end of human tibia, magnified 100 diameters.

the osseous tissue recedes, and the lamella projects into the bony structure; thus, the articular layer is very uneven in thickness, its free edge is also serrated rather finely but unevenly. (Fig. 2.)

On applying higher powers, one sees in many sections little more than this, particularly if they be mounted in Canada balsam; but in those, whether made by grinding down the bone or by cutting thin slices with a sharp knife, that are preserved in fluid, indications were seen which tempted me to go on examining the structure of this articular lamella, until at last I convinced myself that it in reality consists of a series of very minute parallel tubes, which run in a wavy course from the bony to the cartilaginous surface. Among these, but having no special, if any, communication with them, are the bodies mentioned by Kölliker as undeveloped bone cells. In some sections—those, namely, which are not made quite parallel with the axis of the joint from which they are taken—the tubes of the articular lamella cannot be made out, but the section is minutely dotted, from those tubes having been cut across. Fig. 3 is a tolerably successful representation of this structure. It will be seen that certain portions of the articular lamella are rendered darker than others, and this is a condition very difficult to account for; yet perhaps I may pretty confidently affirm that it arises from the tubular structure having become so bent in those lines that the canals have been cut through, giving a brown, darker, and finely-mottled character to that part. This structure is similar in every mammal in which I have examined the lamella, but perhaps it is plainer in the rabbit than in any other I have yet seen.

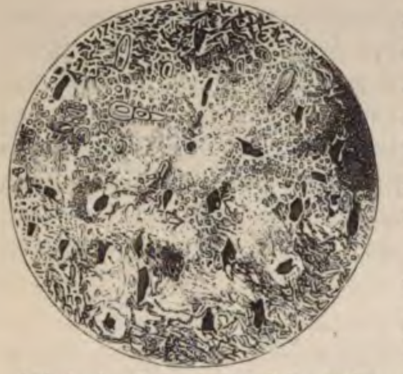
Fig. 3.



Cancellous structure and articular lamella from upper end of the human humerus, showing tubular structure of the lamella, magnified 500 diameters.

Having thus succeeded in ascertaining the structure, as seen laterally, it seemed advisable to view the same part from above; for this purpose a joint end, with as flat a surface as possible, was chosen; either end of the tibia in most animals answers this purpose sufficiently: the cartilage being scraped away, a small

Fig. 4.



Articular lamella, section parallel to surface, from lower end of human tibia, magnified 700 diameters.

piece of the articular lamella was detached, and ground thin enough to be transparent. In this view the black spots or undeveloped bone-cells are less elongated, all the rest of the section is studded with dots, which, under a sufficient power, and where the section is very thin, appear as small round holes. This structure is the same in all animals that I have examined.[1] (Fig. 4.)

Thus the articular lamella is not an impervious material; but perhaps this account, which I have allowed to stand from my first paper on the subject, might have produced less opposition had the wavy lines which run through the section been named something different to "tubes." As far as the bony material is concerned they certainly are tubes, but I do not, and never did, conceive them to be lined by a tubular membrane—probably by compound fibre, or whatever form of fibrous material the altered cartilage may take. The channels, running from the deep or osseous to the superficial or cartilaginous surface of the lamella, permit the passage of nutrient fluid from the bone to the deep surface of the cartilage. This is the one important point—it is immaterial what the channels, through which that fluid passes, be called, whether tubes, osseous intervals, or any other name, as long as it be fully understood, that there is a mechanism permitting fluid to permeate the structure and to nourish the cartilage from its deep surface.

That part of the epiphysis, which remains unossified towards the joint cavity is thus separated from the ordinary bone tissue, and now becomes articular cartilage. It is not, as it has often been said to be, attached to the bone, but it is continuous with it: it is part of the same thing, one portion having received a deposit of lime, the other portion not having done so. It varies in thickness according to the shape of the surface, and always so that its form is an exaggeration of that of the bone: thus, if the osseous surface be concave, the cartilage is thickest at its edges, so that it is more concave than the bone itself. If, on the contrary, we take a convex example, the cartilage will be found thinnest at the edges, so that the whole shape is more convex than the osseous surface.

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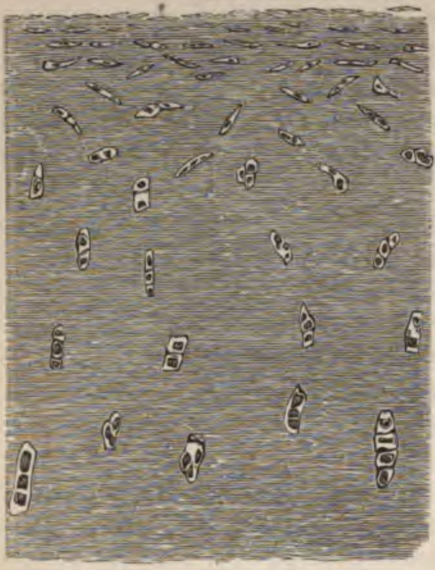
[1] This account of the articular lamella is taken from my paper on the subject in the Med.-Chir. Review, October, 1859.

Cartilage is a tough elastic material, of a semi-transparent bluish appearance, and easily cut with a knife. Treated with strong acetic acid it is dissolved into a jelly, which Müller called *chondrin,* and which differs very little from gelatine. If thin sections be made through the substance of the cartilage and examined by a quarter-inch power, the whole substance will be found to be very translucent, and to have a finely mottled or granular aspect; and there will be seen in it a great many bodies of an oval form. Some confusion has arisen from these having been named cartilage-cells. The truth is, that they are cavities in the hyaline substance, having no lining membrane, which contain from two to six nucleated cells. I propose to call throughout this treatise each body, i. e., cells and hollow, the cartilage-corpuscle, reserving the word cartilage-cell for each one of the bodies contained in the cavity. The cells in the corpuscle not unfrequently, while near the attached surface, separate and cause a division by fissure of the hollow into new corpuscles, and the observer will find the arrangement of these bodies somewhat peculiar, for if he examine a fine vertical section of any articular cartilage in any animal, he will see those cartilage-corpuscles which lie near the attached surface well developed, and containing each from two to six nucleated cells, and near this surface not only do the cells in each corpuscle, but also these latter bodies, tend to arrange themselves perpendicularly to the surface; and when a corpuscle divides it does so in the same direction. As the object is passed under the glass towards the free surface, he will be struck by a change in this respect; the cells no longer remain in the hollow so constantly perpendicular to one another, and as they divide, they do so as frequently horizontally as in any other direction; at last the divisions and the groupings all tend strongly to the horizontal; the cells themselves become separate, and are flattened in the same direction, till at last they become mere scales, three or four layers of which (Fig. 5), lying close together, form the extreme free edge of the section; that is, the unattached surface of the articular cartilage consists of three or four

Fig. 5.



Cartilage from human astragalus, magnified about 700 diameters, showing the perpendicular arrangement of corpuscles at the lower part, gradually curving into an oblique, subsequently into a horizontal position, and drying into scales.

layers of flattened cells lying quite close together and overlapping each other's edges. This arrangement has caused many observers to believe in the existence of an epithelium. If the superficies of fresh cartilage be shaved off thin with a very sharp knife, the section will indeed have the appearance of a layer of epithelial cells; but if a thin slice through its substance be examined, the gradual horizontal arrangement and flattening of the cells will leave no doubt as to the true structure of its superficies.[1] (Fig. 5.)

Some observers, Mr. Toynbee among them, found that in the fœtus vessels run across the cartilage, even into the middle of joints. In neither a fœtal hare or calf, that I had the opportunity of examining, could I discover any such arrangement, nor any trace of it in a stillborn child.[2] Nor have I been able to discover epithelium overlying the cartilaginous surface: what Mr. Bowman took for that structure was, I believe, the superficial layer of cells as above described, which, in the yet unused joint, is finer than when it has been subject to wear and tear.

The position of these cells and their gradual separation from each other, and diminution in size, prove that they derive their nutriment from the attached surface, and this is in consonance with the arrangement in other structures which line cavities, for they are all nourished by the deep surface. Thus the absence or presence of vessels upon the fœtal cartilage is of importance, because if present it would establish the fact of a structure lining a cavity being nourished by its free surface. Besides, as it is clear that, at least during intra-uterine life, there is large provision for nutrition of the cartilage from the deep surface, the presence of such vessels would show that a structure having one free, one attached surface might be nourished from both. Moreover, it would prove that a cellular structure might be nourished from the surface towards which the cells grow. But the two first facts would be isolated, and the last is hardly conceivable; and as others besides myself have failed to discover this arrangement, there must have been in the observation of such vessels some occult source of error.

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[1] This arrangement has, however, not been described as is here done, because it is so difficult to procure sections sufficiently thin, that go all through the cartilage, the outer layers of cells breaking easily from a very thin slice. It may best be managed by cutting away cartilage and articular lamella from the cancelli, scraping the osseous matter away, then laying the cartilage on a piece of cork, and beginning from the formerly attached surface, cutting slices with a well-made and sharp Valentin's knife.

[2] Kölliker could not make out any vessels on the surface of fœtal cartilages.

Moreover, the presence of a plexus beneath the articular lamella, and the structure of that bony plate, distinctly point out the attached surface as the source whence the whole is nourished. Thus a continual growth takes place from the attached towards the free surface, replacing the effects of wear and pressure, which are proved to be considerable, not only by unassisted reason, but also by our present knowledge of the flattening of cells on that surface.

The synovial membrane, wrapping round each bone of the joint and extending from one to the other, shuts them into a cavity. The membrane, by and for itself, is not a closed sac, as has usually been described; but it is a tube, into the ends of which the bony and cartilaginous apparatus of the joint is inserted. It consists of a basement membrane, inside which is a layer of pavement epithelium cells, and on the outside a fine areolar tissue, known by the name of subsynovial, and which carries the vessels furnishing pabulum for nutrition and secretion to the part.

The mode in which the synovial membrane is continued over, or terminates upon, the cartilage, has been a matter of considerable controversy. Some persons have thought that it was prolonged over the face of the cartilage; others, that it went between the structure and the bone; and some even have supposed that it was split, and that a lamina was placed in either situation. Some believe that the membrane is prolonged over the cartilaginous surface until the movements of the joints wear it away. My own conviction is, that at no period is the cartilage covered by synovial tissue, but that the membrane becomes lost very near the edge of the cartilage. In no young animal will any structure be found like a fibrous, or even a homogeneous membrane on the cartilaginous face, and the last layer of cells cannot be regarded as appertaining to a prolonged synovial membrane, since it is very evidently the result of a gradual process of change, and is the arrangement towards which all the corpuscles and cells tend even from their very deepest layers. Histologically, the synovial membrane and the apparatus of bone and cartilage previously described are exact parallels; the former consists, as just related, internally of cells, then of a fine membrane permitting fluids to pass through from a vessel-bearing subserous tissue. The whole cartilaginous apparatus consists of cells (with an intercellular substance), then of a fine lamella, permitting fluids to pass from a vessel-bearing tissue. These structures, or rather set of structures, being analogous, it is hardly conceivable that nature should permit such a tautology as to prolong the one over the other.

The membrane is then a tube, and in a simple joint, as the shoulder, has scarcely any arrangements worthy of being named reflexions; from the edge of the cartilage on the humerus it is prolonged a little downwards on the periosteum, and is then doubled over, courses along, and lines the capsular ligament, till it reaches the other bone of the joint, where, turning again, it passes to a little beyond the cartilaginous end, In a joint, such as the knee, which possesses inter-articular cartilages and internal ligaments, the arrangement is a little more complicated, since the membrane, as it passes from femur to tibia, is interrupted in its course by the menisci, lines their upper then their under surfaces, being folded over the internal edge, and from its outer and lower corner is directed on to the other bone of the joint, the tibia; thus the only part of the meniscus not covered by the basement membrane and epithelium is its outer thick edge; and this is attached by continuity of fibre to the subserous tissue. The crucial ligaments are covered in the same way by folds from the back and front of the joint; and there exists, moreover, a fold that runs from the space between the condyles to the tissue below the patella; mucous ligament. It must be observed that the membrane in its course from bone to bone is not stretched tight, or bound close to the fibrous capsule; on the contrary, it hangs inwards in loose folds, which are marked in all joints, particularly in the knee, where some of them at the side of the ligamentum patellæ have been called alar ligaments. Such a fold fills in the sort of angular interval which, in most joints, is left between the cartilages before they come in actual contact, and permits a plentiful development of loose subsynovial areolar tissue containing pellets of soft fat, and supporting a rich plexus of vessels, which, lying in this fold that encircles the joint, must run round with it, and was thus termed circulus vasculosus.

The inner surface is not merely smooth like that of an ordinary serous membrane: on the contrary, it is studded with a number of villous-like processes, *synovial fringes.* These are more closely placed and better developed on the loose folds than elsewhere; they are particularly well marked in the knee over the lateral folds, alar, and mucous ligaments, &c. These processes, smaller than intestinal villi, are like them, inasmuch as they are composed of vascular ramifications, covered by basement membrane and epithelium; the vessels consist of an artery of supply and a vein, the latter being rather the larger, between which minute capillaries run in a wavy course. I have not found that they carry an absorbent. Their purpose is probably to increase the surface of secretion; but we know in reality so little of this process, that such a phrase has but little value; for aught we can guess to the contrary, the peculiar viscidity and lubricating quality of the synovia may be due to the peculiarity of surface secured by the presence of these processes. The following description is taken from an account of these processes by Mr. Rainey:—

"These structures are situated in those parts of a joint, theca or bursa, where it is least exposed to pressure; they consist of loops and convolutions of capillaries of various degrees of complexity proceeding from the surrounding vessels, and projecting into the synovial cavity; these capillaries are inclosed in sacculi of basement membrane studded with minute oval cellules. From the sacculi inclosing the capillaries numerous other sacculi, into which no capillaries enter, proceed; these are of various forms and sizes, but generally are attached to the primitive sacculus by an extremely long and slender filament of fibrous tissue resembling the petiole of a leaf, the secondary sacculus being its expansion. Sometimes there are several series of these sacculi attached, one series to another, exhibiting an arborescent appearance; but in every instance the secondary sacculi are extra-vascular."[1]

It has been a theory in physiology, that as the synovial membrane is a closed sac it prevents any admission of air to the inner structures of joints, and forms therefore a vacuum, producing thus a pressure from the exterior which aids materially in keeping the joint-surfaces in contact. This theory, however, will not bear examination: when two smooth and moist surfaces, which fit each other accurately, are pressed together, a cohesion of contact takes place between them. The cartilages of joints, being thus smooth and lubricated, adhere together, more particularly in such joints as the hip and shoulder, in which the surfaces of contact are large and fit each other with perfect accuracy, while in such a joint as the knee, whose surfaces are not so reciprocal, but little of this cohesion of contact is produced. It is evident that such an action can only take place between surfaces actually in contact at the time, but is quite independent of, is in fact annihilated by, any vacuum established around them; as it will take place in the open air when any moist smooth surfaces, as metal or plate-glass, come in close contact, but will not be produced in a vacuum, as in the bell of an air-pump. Thus, then, this theory of a synovial vacuum is not only quite unnecessary, but is actually vicious, as it does not elucidate that which it was invented to explain (a fact quite explicable of itself), but renders it inexplicable. Again, if the synovial membrane were a vacuum, it would be forced with a pressure of fourteen and a half pounds to the square inch between the joint surfaces, and would thus be pinched and bruised on almost every movement of the limb. The experiment of puncturing the synovial membrane of a hip-joint in the dead subject, and producing thereby an instantaneous dislocation, is open to innumerable sources of fallacy, and therefore is insufficient to prove such an untenable theory as that of synovial vacuum. The experiments and reasoning whereon this vacuum theory is founded were made by E. Weber, of Bonn, and communicated in Müller's *Archiv.*, 1836, p. 54.

"Now I will give an investigation into the power whereby the head of the thigh is held in juxtaposition with the pelvis. It has been supposed that the limb was fastened to the trunk by the strength of the muscles or ligaments, because such power is the most visible. More careful examination, however, has shown that this is not effected by the power of muscles and ligaments, but by a far less perceptible force, namely, by the pressure of the surrounding air.

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[1] Pathological Transactions, vol. ii. p. 110.

"The head of the thigh-bone, which fits air-tight into the globular hollow of the acetabulum, adheres in that cavity as the air-tight piston of a syringe remains in the tube when its upper opening is closed.

"As the quicksilver in a barometer is driven upwards by atmospheric pressure, so is the head of the femur, when there is no air above it, driven upwards into the acetabulum. I will give shortly the experiments which led to this result.

"EXPERIMENT I.—The body was brought into such a position that the limb hung freely down. If then the limb hung by the muscles and ligaments, it would fall out when those parts were cut through. I severed the muscles and ligaments, and the limb did not fall; on the contrary, the joint surfaces remained in close contact.[1]

"EXPERIMENT II.—Admitting that atmospheric pressure holds up the limb, it would fall as soon as air were admitted into the joint cavity. I bored a hole through the wall of the acetabulum through which air entered—the limb fell, even though the muscles and ligaments had not been divided.

"EXPERIMENT III.—Admitting that atmospheric pressure is alone sufficient to support the limb, it should be again supported after having fallen out of the cavity when air was prevented from entering the joint. I replaced the head of the thigh, which had been entirely separated from the body, and then, in order to keep air out of the cavity, I closed the hole which had been bored with my finger—the limb was then supported and again fell down as soon as the finger was removed."

Let us examine these experiments a little closely before I relate some of my own. Either the head of the thigh-bone is in actual contact with the acetabulum or it is not. If they be in actual contact, cohesion of contact takes place as between any two smooth surfaces, and a hole bored in any part of those surfaces would only affect that cohesion at the place actually bored. If, on the other hand, they be not in contact, there will either be a vacuum (as far as air is concerned) between them, or there will not. If air be between them, the theory of atmospheric pressure vanishes; if there be no air between them, but a vacuum, Professor Weber did not re-establish that vacuum by merely replacing the head of a thigh-bone in the cavity. Neither on the supposition, therefore, of a vacuum in the joint cavity, nor on that of inter-cohesion of surfaces, can all the results of these experiments be explained. I cannot account for the attainment of all these phenomena, nor can I procure such results; they are incompatible with one another. One source of fallacy may have been, that, in boring a hole, Professor Weber unwittingly pushed out the head of the bone with the point of the instrument.

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[1] This is as easily accounted for by the cohesion of contact between the cartilaginous surfaces.—R. B.

I will now relate some experiments of my own; the first was performed for another purpose, and is more fully related in Chapter XV., in which it appears as Experiment III.

Experiment I.—The subject was placed upon the table on the back; means of accurate measurement by needles, fixed one in the thigh, the other in the pelvis, were adopted. A weight of 28lbs. was hung upon a system of three pairs of pulleys fastened to the ankle, thus constituting an extending force of 756 lbs: no change in the position of the limb or in the measurements was found. A hole was made in the inner wall of the acetabulum: still no change in the position of the limb or measurements. For the other purpose above mentioned a wedge of an inch thickness was driven in between the femur and the acetabulum; when this was removed the head of the femur kept the same place, namely, separated from the acetabulum. The weight was unfastened, and the head of the femur returned to its normal position with a sound precisely like that produced by disarticulation.[1]

Experiment II., in the presence of Dr. Hyde Salter, July 6th, 1860.—The subject was placed on the back, the weights and pulleys prepared as before, and the same system of measurement adopted. The capsule of the hip was carefully laid bare without puncturing, the tendons of the psoas and iliacus divided, and weights equal to 35 lbs. were hung on the pulleys; a hole was rapidly bored in the floor of the acetabulum; a minute and a half after this was done, a suction sound was heard, and the head of the femur came out of the cavity. The weights were lifted, and the femur replaced and tightly pressed in the cavity, the finger firmly held over the hole, but whenever any weight was allowed to hang on the thigh the head of the bone fell out, nor could I by any means find the slightest difference whether the finger were held over the hole or not. There occurred, immediately weight came on the thigh, an oozing sound, the sound of squeezing soft moist materials, and the head of the bone fell from the cavity. In this experiment the force exerted was very large.

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[1] These results are incompatible with those of E. Weber's second experiment, in which the hip (muscles and ligaments being entire) dislocated on boring a hole in the acetabulm.

Experiment III., in the presence of Dr. Hyde Salter.—The same division of muscles and other dispositions were taken. The force was a stone weight on the three-pair system of pulleys. A hole was bored in the inner floor of the acetabulum and enlarged so that the head of the bone could be felt with the finger. During the work the caput femoris was struck once or twice with the gouge, and the femur would start outwards or rotate slightly, but the length was precisely the same, and no separation of the articular surfaces could be found. (In this instance the weight was not sufficient to overcome the cohesion of contact). I now took off the weight and the cords, and endeavored to dislocate the head of the bone by forcibly twisting the limb in every direction. I most nearly succeeded when, the thigh was rotated outwards and abducted even beyond the middle line. Still it could not be done until the cotyloid ligament was divided, and then only partially without division of the round ligament.

Experiment IV.—All the muscles round the capsule were divided; but the psoas was left entire. The capsule close to the edge of the cotyloid ligament was cut through, leaving that structure entire. This division should have destroyed the machinery for any intrasynovial vacuum, and the head of the bone therefore should have fallen out of the cavity, but I had the greatest difficulty to dislocate the hip, and could only partially succeed without dividing the ligamentum teres.

A curious case occurred to me, which is related at length in the ensuing chapter. A man had an opening into the synovial membrane of the elbow-joint, which, when he alternately bent and straightened the arm, sucked air in and out of the cavity like a pair of bellows. This was a strong man, a sailor, who had a great deal of climbing and other hard work to do, and yet had no discoverable tendency to dislocation.

The whole vacuum theory is untenable; the only fact which at all resembles it is, that cohesion of contact takes place between the joint surfaces, but this is not a vacuum: a vacuum is a space containing neither air nor other material—the cohesion we speak of takes place when there is *no space* between the parts interested.

The fact is, that every joint has some special means, which hold the bones forming it in close contact, and such aids as atmospheric pressure may yield are but slight in comparison with these. Certainly no man gifted with a tolerable appreciation of cause and effect could regard the enormous power of the muscles passing from the scapula to the tuberosities close to the head of the humerus without considering that their tonicity alone would be of large effect in keeping the head of the bone close against the glenoid cavity. Any one attempting to resect the head of the humerus in the dead subject cannot fail to remark their effects, even as lifeless flesh; and moreover he will find the ligaments and the tendon of the biceps and other parts of the greatest importance. Again, if the rotators of the hips and their direction and attachment be considered, their importance will not be slightly regarded, and besides these the psoas, iliacus, and glutei, in fact every muscle attached to femur and pelvis, have the same effect. Add to this the resistance of the cotyloid ligament, which forms a smaller circle than lies within the cavity, and therefore clips in the bone like a circular clamp, and we have quite enough to account for the difficulty in dislocating the bone.[1] Besides, there is the round ligament, which in certain positions takes considerable part in holding the head of the bone in the acetabulum.[2] The knee, elbow, all the joints in the body, have arrangements either of muscular force or ligamentous resistance for keeping the articular surfaces in contact. By this means only, viz., actual contact of the bones, can any assistance from atmospheric pressure be obtained. A vacuum, i. e., a space unfilled by air between the bones, could not be maintained: either the surrounding parts must be forced into such space or the bones would be squeezed together, for there is nothing to keep them asunder, and so the space would be annihilated.

The material which surrounds the basement structure of the synovial membrane is called cellular, or, better, areolar tissue. This structure is one of the most remarkable in the body, not only for its wide distribution, its elasticity, its peculiar insensibility to certain stimuli or irritants and its quick resentment of others, but also for its peculiar actions under injury, and its enormous power of repair. It consists of the two sorts of fibrous tissue, viz., yellow and white, mingled together in an inextricable and beautiful manner. These two elements are different in many ways, and will require each a separate description. The yellow fibrous element consists of round branching fibres, which always lie singly, i. e., never in parallel bundles, and whose ends, whether natural or broken, have a great tendency to curl up. Beyond these qualities, however, it is one of the most varying formations in the body, and it is very difficult to observe it constantly under similar circumstances. For instance, Mr. Queckett appears chiefly struck with its curved and curling nature, and both in his descriptions and delineations has constantly figured it as a crooked fibre, giving off branches at either side which curl spirally. (Queckett's *Histology.*) Mr. Bowman, on the other hand, looks upon and draws the fibres straighter and inosculating, more like the strings of an irregularly constructed spider's web. (*Physiological Anatomy.*) The truth is, that both these forms are common—the former most so in the *ligamentum subflava,* the latter in the fine areolar tissue, which connects the folds of the peritoneum, or lies between two muscles. In that texture which forms an aponeurosis, for instance the lower part of the facia transversalis and the tissue near it, both forms are to be seen, but the larger curly fibres are more abundant. Acetic acid only affects this yellow fibre by causing it slightly to contract and pucker. White fibrous tissue is that which makes up the chief bulk of ligaments and tendons. As seen in areolar tissue it appears to consist of bundles of minute wavy fibres which undulate in and out of the meshes formed by the yellow tissue. Very often the bundle incloses some of these latter fibres, which seem to run through it at an angle. Reichardt supposes that these, which look like bundles of fibres, are not really such, but are masses of wavy tissue minutely striated, and having a remarkable tendency to split lengthwise. By the addition of very dilute acetic acid the fibrillated appearance is lost; on longer exposure to the reagent the whole of the white element, however, vanishes, and hence it is hardly safe to infer from the disappearance of fibrillation that fibres do not exist.

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[1] In my Experiment II. the weight hung on the pulleys produced a force sufficient to overcome this ligament and open it out; subsequently, therefore, whether or not air was admitted into the cavity, the head of the bone fell out on the application of the force.

[2] The reader is referred to a paper by Dr. John Struthers, in the Edinburgh Medical Journal, vol. iv. 1858–9, p. 43, for a particular account of the use of the round ligament. It appears that the position *par excellence* wherein this band may act as a check ligament, is rotation outwards with flexion. It is rendered nearly tight in adduction with flexion, and in adduction with rotation either inwards or outwards; but only in the first-named position does it bear the strain.

If we dissect carefully through the fat surrounding a ginglymoid joint, say at the front of the knee, till we come to what appears the outside of the synovial membrane, where adipose tissue begins to fail, one is able to take up with the fingers or forceps, and to strip off to a certain distance, thin transparent films having the aspect of continuous membranes. If one of these be cut off with the scissors, and placed under a power of 250 or 300 diams., the wavy bundles of the white areolar tissue will be found so abundant as nearly to conceal the yellow element. The tissue can be constantly spread out with needles thinner and larger; there seems no end to this power of stretching, but the more it be thus pulled out the more and more do the yellow fibres come into view. Moreover, if we take the film originally some way from the basement synovial membrane, the white fibre is markedly predominant, whereas the nearer we get to that membrane the more distinct is the yellow tissue. This may be best made out in the examination of a ball and socket joint by cutting capsular ligament and synovial membrane quite through, separating the humerus entirely from the scapula—taking hold in one pair of forceps of the edge of the ligament, in another of that of the synovial membrane, and dragging them apart, there will be stretched between them many films of membranous material; and if we examine some of this close to the ligament microscopically, the white fibrous element will be seen to conceal the yellow; if, on the contrary, we take the portion to be examined from quite close to the synovial membrane, the yellow predominates until we find that the tissue immediately underlying the basement membrane consists of a meshwork of fine yellow fibres interlacing and branching in all directions so as to form the most elastic, most yielding, and most even possible support to that delicate structure. Thus, as in our examination we recede further and further from the joint surface, so do we find the subsynovial tissue becoming denser and whiter, until at last in such a joint as the shoulder it mingles insensibly with the capsular ligament. Or, if we would wish to put the description into other words, we might say the capsular ligament becomes, on proceeding inwards, more and more loose and soft in texture; its fibres gradually lose their parallelism, and become mingled with more and more yellow tissue until they, instead of forming parallel-fibred bands and cords, shape themselves into an irregular meshed net, over whose most internal parts the thin sheet of synovial membrane is spread. This gradual transit of structure may be exemplified in the knee: this is a joint which is not provided with a capsular ligament, properly so called, although it is protected by a more or less dense tough areolar structure, consisting chiefly of white fibrous tissue continuous with the subsynovial areolar membrane, or rather this capsule is the outer layer of that structure. It connects the special ligaments together; in fact these latter are but stronger bands of the ordinary capsule, just as the coraco-humeral and the ilio-femoral ligaments are but stronger bands of the capsular ligaments of the shoulder and hip-joints. In the knee, and indeed in most other joints, the surrounding fibrous structures are strengthened by bands of white inelastic fibres which the tendons immediately in the neighborhood give off; this arrangement has, however, a further object, as will presently be shown.

The ligaments of joints are then to be regarded not as isolated or separate structures, but rather as constituent parts of the periarticular tissues; the fibres are straighter than in the ordinary white tissue, but they are in reality the same structure a little differently arranged, and the ordinary white tissue runs among them; also long spindle-shaped cells are placed among the parallel fibres.

Both the white and the yellow fibrous element are crowded with cells of different forms; they are long and spindle-shaped in the white wavy tissue, and lie wedged in, as it were, among the fibrillæ; they are close together both in a longitudinal and in the transverse direction, not, however, in contact. Virchow (*Cellular Pathologie*) believes that they intercommunicate by fine tubes given off at either end. However that may be, they certainly retain their nuclei, and contribute to the nourishment of the tissue; indeed, the whole structure is, like other connective tissues, to be regarded as a mass of cells with an intercellular substance. In this instance the cells are arranged in lines, and the intercellular material is fibrous.

The exact arrangement of the cells in the yellow tissue is less easily described; many of them are fusiform, or are even cell-fibres, and it seems in many parts as though the fibres were only prolongations of the taper ends of the cells. In other parts stellate cells are found (*Bindegewebskörperchen* of Virchow), and even the rays of these stars seem to be continued into fibres. These prolongations are also regarded by Virchow as tubes, but this requires more proof. Many of the cells are large and well-developed, and contain well-formed nuclei; their action under inflammation is most important, as will be seen in the sequel, and their value as nutritive agents is undoubted.

The interarticular fibro-cartilages are seen in their phase of highest development in the knee-joint; they consist, on upper and lower surfaces, of a thin covering of membraniform cartilage, the thick cushion-like parts are formed of dense bands of fibrous tissue crossing each other in every direction, and thus forming wide and irregular-shaped meshes which are filled with fat—in fact, by far the larger portion of the structure is made up of fat thus inclosed. The cartilaginous portion of the structure is in the adult very thin, and by no means easy to find; in the young fœtus the whole menisc may be examined, and when its inner thin edge comes under the glass, its membrano-cartilaginous structure will be evident. Over this material the synovial membrane passes in the way already explained, leaving only its outer thick edge uncovered—if, indeed, that may deserve the name of edge which is in continuity with the rest of the areolar tissue around the joint, for as far as the synovial cavity is concerned these structures are outside the joint altogether. At the lower jaw, and the sterno-clavicular joint, the interarticular cartilage is not perforated in the centre, but is one continuous plate; hence in these instances are two synovial membranes, and therefore two joints.

The nervous supply of joints is complicated, and often multifarious, combining twigs from at least two of the trunks going to the muscles of the limb. The nerve to the joint is doubtless sensory, and is one of the sensitive portions of muscular nerves. All the motor nerves have one or two sensory filaments combined with them, which impart to the muscle that which is called "the muscular sense;" directing and limiting its contraction. In the same way, there is a joint sense bestowed by exactly the same nervous means, and, having similar origin with the muscular sense, has like function, being able to increase or diminish the amount of contraction according as one part or another is compressed. For instance, observe the violent spasm which seizes the muscles of the thigh, and many of the leg, when loose cartilage gets between the bones, and the violence with which the muscles of a limb contract, when from any malposition in placing it—for instance, when the foot comes sideways on the ground—the joint is abnormally compressed; this contraction is so violent that the tendons and their sheaths are bruised, forming one sort of sprain. One valuable effect of this supply is protection of the synovial membrane by the influence of the tendons attached to the capsule.

The synovial membrane would be liable to be pinched in many movements of the joints were they not protected by the mode in which the muscles surround them, and are attached more or less strongly to the capsular ligaments where they exist, or to the subsynovial tissue where they are absent. This attachment is more constant than is generally imagined; not only does it exist in all the larger joints, but also in all the small ones that possess a tolerably free amount of motion. Sometimes there is a special muscle for the capsule; sometimes the same effect is produced by the partial attachment of the ordinary flexor, extensor, or other motor of the limb. The method in which the scapular muscles and the small rotators, psoas, and iliacus, are attached to the capsule of the shoulder and hip-joints respectively is well known.

The intimate connection of the triceps, extensor, and anconeus with the back, of the brachial anticus with the front, of the supinator brevis with the outside of the elbow-joint, is very analogous to the attachment of the quadriceps extensor femoris with the front, and of the popliteus and semi-membranosus with the back of the knee-joint. At the wrist the amount of movement is very small in comparison to those joints already mentioned, and therefore there does not seem necessity for any such protective apparatus for the synovial membrane; but the ankle is provided with an especial muscle to draw the membrane from the grip of violent extension, viz., the plantaris. Each synovial membrane of the digital joints, both of fingers and toes, is in connection with the extensor and interossei tendons, so that ample care is taken, even in these small articulations, to prevent pinching or other such injury. The interarticular cartilage, whose inner parts are but continuations of the periarticular areolar tissue, would naturally be drawn out when the muscles attached to this tissue contract; but they are usually provided with their own muscular attachments; thus, in the inferior maxillary joint the external pterygoid sends a few fibres to the intermaxillary cartilage, while the tendon of the popliteus is connected with the outer, and some fibres of the semi-membranosus with the inner meniscus of the knee-joint.

The nerves which supply these muscles are twigs from the same branches that supply the inside of the joint; the twig to the joint is of course sensory, and supplies that knowledge of motion, position, &c., which in the muscles is called muscular sense, and this sense by a sort perhaps of reflex action causes those muscles to act whenever some motion or some position places the capsule in danger. It is curious that one of the nerves at least of these capsular muscles, namely, that to the teres minor humeri, should possess a ganglion; and I have reason to believe that others are likewise so provided—the popliteus, for instance—but have not yet been able fully to demonstrate its existence.

The vascular supply of a part, that is to say, the precise branches whereby blood is brought to its tissues, is not, in my belief, of very great importance; but it may be pointed out that the epiphysis receives its nourishment not from the vessels of the diaphysis, but from certain branches entering its sides (p. 21.) These are derived from the same vessels which supply the synovial membrane. For instance, from the circumflex at the shoulder-joint, from the articular arteries at the knee, and so on.

Such is the physiological anatomy of parts entering into the formation of joints. It has not been thought advisable to increase the length of this unavoidably long chapter by any descriptive anatomy, which moreover is of course well known. It must however be remarked, that in order to form correct diagnoses of synovial inflammations, it is necessary that the shape, divisions, and prolongations of all those membranes, as well as the position of the structures which bind them down, be well known.

CHAPTER II.

ACUTE SYNOVITIS.

PATHOLOGY.

A JOINT is, as the preceding chapter has shown, a very complicated apparatus, constructed of different tissues of different qualities, hard, soft, and elastic, serving different purposes. Yet they are all reducible to one form or class of tissue—the connective. Those different parts are so closely placed, and are so interdependent, that one cannot long remain sound while the others are undergoing any active morbid change. But some of the structures are more liable to disease than others, as indeed it must happen that those parts which undergo much action are, *cæteris paribus*, more likely to get some of it deranged; and such derangement is more likely to set up rapid disease than when the action is very slow, as a railway train going at the rate of sixty miles an hour is at least six times as likely to meet with an accident during that hour as one which goes at ten in the same time, and that accident is more likely to be severe. We shall be able to show clearly that the structures which are liable to primary disease are the synovial membrane and the bones. From either of these points the malady may spread to every other part of the joint; therefore, after either has been affected for a certain time (synovial membrane or bone), the other becomes involved. Hence neither synovitis nor osteitis are utterly different throughout all their stages, because in the far advanced conditions the one disease will be more or less mingled with the other.

The present chapter will be devoted to primary acute synovitis: a disease which perhaps acknowledges more causes than any other simple malady in the range of pathology, and which therefore may be divided into an almost indefinite number of sub-classes, each with its proper expletive affixed. Perhaps the clearest way of showing this would be to relate one or two cases.

Case I.—Hannah Parkes, ætat. 49, was brought to the Charing-Cross Hospital, 5th December, 1859, and placed under my care, through the kindness of Mr. Hancock. She states that, the night before, she fell down, and that her left knee was twisted under her so as to produce intense pain, which continued, and soon after the knee began to swell.

The left knee is much swelled, and has lost its shape; the form of the bones is no longer perceptible, the patella even being nearly concealed by a bulging out of fluid all round it; this is more particularly remarkable on each side of the ligamentum patella, and beneath the vasti muscles; the patella is lifted from the femoral condyles, and can, by slight pressure, be pressed back upon them. There is a good deal of heat, but no redness of the part. Measurement gives nearly two inches as the amount of enlargement, thus, the right knee (sound) measures—

Just above patella	12½	inches.
Across middle of patella	12¾	"
Just below patella	11	"

Left knee (diseased)—

Just above patella	14¼	inches.
Across middle of patella	13½	"
Just below patella	12¾	"

Her tongue is rather white, pulse 90, bowels regular, no unusual thirst.

℞. Calomelanos gr. ij.
Pulveris rhei gr. iv. M.
To be taken at bedtime.

The limb to be placed on a splint, and 6 leeches applied to the knee.

8th. The knee is more swollen and painful; she did not sleep on account of the pain last night; the dimensions to-day are—

Left knee, above patella	14½	inches.
" " across patella	13¾	"
" " below patella	13	"

It is ordered to be cupped to six ounces.

10th. She complains still more of pain, which keeps her awake at night: during last night she removed the splint, and says she is much easier without it, and, as there is no fear of her moving the limb, she is allowed to be without it. Hot fomentations to be kept on the part.

12th. More blood was yesterday taken by eight leeches from the knee; after their removal a hot poultice was applied. The dimensions to-day are—

Above patella	14⅛	inches.
Middle of patella	13¼	"
Below patella	12¾	"

14th. The pain has diminished; she is to continue the hot applications, and a splint bent at a greater angle is to be applied.

16th. Goes on well; the swelling has decreased slightly.

Above patella	14⅛	inches.
Middle of patella	13	"
Below patella	12¼	"

18th. The pain is now slight, and the swelling appears less; there is also less heat. Fluctuation is more obscure, as though it were felt through a thicker material.

21st. Dimensions—

Above patella	14 inches.
Middle of patella	12¾ "
Below patella	12⅛ "

24th. Fluctuation much less distinct, and the shape of the bones begin to reappear, but somewhat altered, the protuberances appearing rounded off. When the hand is applied over the patella, and the joint moved, a crackling therein is very distinct.

Dimensions—

Above patella	13¼ inches.
Middle of patella	13⅛ "
Below patella	11¾ "

25th. She went away; the knee stiff, somewhat tender and enlarged, about ¾ inch in all dimensions.

Case II.—M. G. came to my house, 28th November, complaining of great pain in the right knee and ankle.

Those joints are swollen and red, and very hot to the touch; tongue white, furred; pulse 96; much thirst and headache; face flushed; eyes rather injected. Ordered that she should go home and to bed, to take an ounce of castor oil—wrap the painful joints in flannel.

In the evening I called and saw her; she had intense headache; the oil had operated, and the tongue was rather cleaner. The knee was very painful, swollen, red, and hot. No dimensions were taken, but the form of the bones was hidden by a soft puffy swelling, which bulged chiefly above the patella and at the sides of its ligament, and which lifted that bone from the femoral condyles. The ankle is not so red nor so swollen, but is very hot. The swelling is most perceptible in front of the malleoli, and at each side of the tendo-Achilles. The urine is high in color, scanty, and loaded with lithates. Ordered

Vini colchici ♏xx to be taken in water every six hours.
Pilula hydrargyri chloridi comp. (gr. v) night and morning.

30th. She was much in the same condition yesterday; the pain in the head has decreased, the joints are just the same, but she has some pain in both shoulders, which is, however slight, and they are not swollen. I asked Dr. Hyde Salter to see this patient with me.

Dec. 2d. Yesterday she had a slight shivering, and the pain afterwards in the shoulder increased, it then left the knee entirely. To-day the right knee has resumed its normal temperature and color, but the shoulders are very painful; they are also red, swollen, and hot; the swelling is most in front, under the deltoid, which is pressed forward; obscure though evident fluctuation. Ordered the following draught every six hours:—

℞. Vini colchici ♏xx.
Sodæ sesquicarbonatis gr. x.
Aquæ ℥j. M.

5th. The heart has been daily examined, and to-day there is friction sound; the tongue continues white; the shoulder and ankle-joints are less painful, but swelling and pain have begun in the left knee; both hands have become affected in almost all their joints; pulse small and hard; six leeches were ordered to the chest; two grains of calomel and one-half grain of opium night and morning—to continue the mixture.

It is useless to follow out the case day by day. Under the treatment of my friend Dr. Hyde Salter the symptoms diminished. I myself saw her constantly, being interested in the joint affection. The swelling of the various joints attacked gradually diminished, and with it the pain. In about a month from the first attack every joint had recovered its normal size, and merely occasional uncertain pains were felt. Tonics being administered, completed the cure.

CASE III.—G. B., in good circumstances and of strong constitution, contracted, at the age of 25, a gonorrhœa; nine days after the appearance of the complaint he was exposed to great fatigue; afterwards he lost his appetite. On the evening following he had three or four violent shivering fits, with sickness and pain in the head, and sent for me 5th February, 1854. The tongue was furred, red at the edges, brown in the centre, more particularly towards the back; pulse 100, small, hard; eyes glazed, somewhat anxious; bowels confined; urine scanty, high colored, full of lithates—the gonorrhœa appeared much diminished. I ordered a calomel and jalap purge, and proposed to see him on the next day.

6th. I found him in considerable pain at the right knee, which was slightly swollen; he was very restless with the pain in the knee, which he compared to what might be felt if a crowbar were forced in and the bones wrenched asunder. The skin over the joint has its natural color, but is very hot; pulse 100, small; tongue cleaner, still dry and brown at the back. The purge has operated freely. To apply six leeches to the knee. To take the following pill night and morning; the draught three times a day:—

℞. Calomelanos gr. ij.
Opii gr. ss. M.

℞. Vini colchici ♏xx.
Potassæ carbonatis gr. xv.
Misturæ camphoræ ℥j. M.

8th. The knee is still very painful; the left shoulder has to-day been tender; he lies very still, fearing to move the joints. He is very desponding; the pulse is small and weak; tongue still brown and dry. To continue the medicine, and to take strong broths and six ounces of wine daily.

11th. He is still in very great pain; the knee is more swollen, the swelling is soft, fluctuates slightly, and pits a little; there is effusion both in the joint and in the periarticular tissue; the general state is the same.

14th. Knee still in same condition; the shoulder is painful to-day, and perhaps may be swollen. The eyes are rather suffused, the face pale, expression despondent. The gonorrhœa is now very slight. To apply six more leeches to the knee; a gutta-percha splint was also applied.

18th. The shoulder is now swollen, and since last report has been very painful; it is very hot, but of natural color; tender. To omit the pill, and add to each dose of the mixture

Liq. opii sedativa ♏xv.
Vini colchici ♏x.

21st. The left wrist has now begun to be painful; the right ankle also; the whole foot is swollen, presenting a white appearance similar to that observed in phlegmasia dolens.

24th. The right knee is rather less painful, perhaps also not quite so much swelled, but fluctuation is as plain if not plainer than before; the tongue and pulse are still just the same; he has no desire whatever for food.

28th. On the evening of the last report the left knee was attacked with pain, which was for three hours very severe, then decreased; the joint is but slightly swollen, is still slightly painful; feet very much swollen and very painful. The medicine has begun to purge, but I cannot see that it has produced any benefit. To leave off all medicine for a day or two; to take as much broth, soup, fish, egg, as can be managed; ten ounces of wine a day; to wrap the feet in cotton wool.

March 2d. The purging has ceased; there is a slight improvement in countenance and manner; tongue cleaner; pulse much the same.

To take two tablespoonfuls of the following mixture three times a day:—

℞. Ammoniæ sesquicarbonatis ʒj.
Træ opii ʒiij.
Decocti cinchonæ ℥xij. M.

Castor oil when necessary.

6th. The pulse has improved slightly; less despondent; the right knee is less hot, and there is less swelling; fluctuation is still distinct; the decrease appears owing to the absorption of the fluid outside the joint. To apply a blister inside and rather above the joint.

10th. Knee still decreasing; a blister was yesterday applied to the shoulder. The feet are still as much swollen. To leave off the cotton wool for two days, and then to use cold lotions.

12th. A blister to the other side of the knee; to take five grains of quinine, in the form of a pill, three times a day.

This patient became convalescent under a strong tonic system and frequent blistering to promote absorption of fluid, about the latter end of March. At that time he could walk with the assistance of two sticks; it was not till the beginning of June that he perfectly recovered the use of his joints. In 1858 he had another gonorrhœa. I gave, from the very first, quinine; he had no so-called gonorrhœal rheumatism, but whether the tonic prevented it, or whether it would have come on at all, cannot be affirmed.

Case IV.—Sarah Crowe, ætat. 20, was admitted into the Charing-Cross Hospital 11th December, 1859.

About the beginning of December she had on a pair of boots in which a projecting nail had wounded the right heel; the place was painful, though nearly skinned over on the 8th. On the morning of the 9th she was awoke by pain in the right groin, which was tender to the touch, and she thought it a little swollen. However, she went to her employment (sedentary), and about noon the pain suddenly shifted to the knee and was very severe; the joint also swelled. In spite, she says, of great suffering, she got through the 9th and 10th; on the 11th came as an out-patient to Mr. Hancock, who took her in.

The leg was swollen to the middle of the thigh; some glands in the groin were enlarged; there were red lines running up from the ankle in the course of the absorbents, and of the posterior saphenous vein of the leg and saphenous vein of the thigh. The knee was swollen, fluctuating, and tender, but preserved its natural color except where crossed by the reddened vessels. Pulse 90, small; tongue white; bowels open; old wound at the heel was laid open; a drop or two of pus escaped.

Ordered to take the following, as a pill, three times a day:—

℞. Hydrarg. chloridi gr. ij.
Opii gr. ss. M.

Six leeches to be applied to the knee.

15th. The knee and thigh are more swollen, the latter more particularly at the outer side; the general condition much the same.

18th. There is evidence of an accumulation of pus beneath the fascia lata on the outside of the thigh, four inches above the joint; an opening was made in this situation; some pus escaped at the time.

To take the following draught three times a day:—

℞. Ammoniæ sesquicarb. gr. v.
Decocti cinchonæ ℥j. M.

Eggs; roast meat; four ounces of wine.

21st. The opening made in the thigh gives exit to a considerable quantity of pus. She is in considerable pain from the knee, which is more swollen, but remains of the same color as at first. Add to the draught

Træ camphoræ comp. ʒj.

24th. In less pain; the knee otherwise the same. The saphenous vein of the thigh feels hardened and knotty; the groin is swollen and tender.

Jan. 3, 1859. Her appetite has fallen off, and she complains of headache. Bowels confined, probably from the amount of opium taken.

Mist. rhei co. ℥j to be taken every other morning.

6th. Much less pain in the knee, which is less swollen, but the groin continues painful; the red lines have been slowly disappearing.

To take the following pill night and morning:—

Pil. hydrargyri gr. v.

The draught, three times a day:—

Mist. quinæ ℥j.

A blister to the knee.

10th. Hardly any pain in the knee except from the blister; it is but little swollen; the wound in the thigh has healed; the glands in the groin still enlarged, but hard.

18th. The groin is still swollen; a blister to be applied over the glands. The knee only very slightly enlarged. From this time the treatment was only directed to the state of the groin, the fluid in the knee-joint becoming gradually absorbed.

CASE V.—E. B., ætat. 32, had contracted a syphilitic sore at Aldershott; by some means he had either not discovered this, or had neglected it. Came to me November 26th, 1858. Had already lepra syphilitica. I had known this gentleman some years, and was rather afraid of the effects of mercury; treated him, therefore, as mildly as I believed was safe.

He had been under my care seven days, and was taking, thrice in the day,

℞. Potassii iodidi gr. iij.
Decocti sarzæ ℥j. M.
And pil. hydrarg. chlorid. co. gr. v every night.

August 8, 1856. I was sent for on account of the patient being unable to walk from pain and swelling of the left ankle; the joint was slightly swollen, rather hot, not red. He was not aware of having received any sprain.

Hot poultices to the part. Calomel gr. ij, opii gr. j, to be taken immediately.

9th. He suffered last night more than usual from pain in the left shin, and to-day the ankle is very visibly swollen in front and behind the malleoli.

Ordered six leeches and hot fomentations to the part. To take

Pil. hydrargyri gr. v night and morning.
Pil. saponis co. gr. v at bedtime.

11th. The joint still swollen; less pain at night.

As the medicines began to affect the constitution the swelling in the ankle subsided; the inflammation from the first was not very acute, belonging rather to the subacute order. Even when the nocturnal pains and eruptions had disappeared, and no syphilitic signs were left, the synovial inflammation became chronic.

These are all cases of synovitis; and although the inflammation of the synovial membrane is that alone which they have in common, yet, locally, the morbid action is, up to a certain point, very much alike in each: there is pain, heat, swelling, the ordinary signs of inflammation; in some the redness extends externally—in others, it does not do so. The cause in each is different. The first arose from violence applied to the part; the second, from a systemic condition; the third, from a gonorrhœa; the fourth, from a fever; the fifth, from a syphilitic disease. In the first case only can the disease be said to be local; or as local as any disease producing more or less symptomatic fever can be; it is therefore called simple synovitis: had the malady followed a wound, it would have been called traumatic synovitis. The second example is one of rheumatic fever, acute rheumatism, or acute polyarticular rheumatism. The third is erroneously called gonorrhœal rheumatism. The fourth is synovitis from pyæmia. The fifth is syphilitic synovitis, more acute than usual. The general, or systemic symptoms of all these cases are different, and from their variation must the particular form of the complaint be diagnosed.

It is very difficult to give any good reason for the extreme partiality which this disease shows for certain joints. If it arise from cold, there seems some ground for saying that a superficial joint, like the knee, would be chiefly attacked; but why should pyæmia, when only one articulation is the seat of its peculiar synovitis, nearly always attack the knee? Gonorrhœal rheumatism often attacks no other joint, and never, as far as my researches have gone, leaves the knee unaffected; and I do not know of any case of poly-articular rheumatism in which the knee has escaped, though we find many recorded in which other joints have remained free. It is, I believe, better to avoid speculative reasoning on such points as this, and where there is so little clue to guide us, to be content with the fact—which may be thus stated. That of all cases of acute synovitis (leaving out rheumatic fevers) eighty-five per cent. occur in the knee.

With regard to age, it may be said, although we have no reliable statistics to guide us to an actual percental reckoning, that the disease is most common among males (again omitting acute rheumatism), and occurs most frequently at that period of life when muscular strength and bodily activity are most powerfully developed.

It is extremely rare that we have an opportunity of examining pathologically into the changes produced by a simple acute synovitis. The disease is not fatal, and therefore, if the patient should die from other causes, the synovitis will probably have become chronic, or disappeared. However, once in my life it was permitted me to examine such a case: the results are reported here.

CASE VI.—A man, aged 40, was brought to St. Thomas's Hospital, having fallen a considerable height through a skylight, and received an injury to the head.

He was bleeding from the right ear, had a severe bruise over the forehead, and was insensible; he was taken at once to the wards. The next day, also, he remained insensible; but it was found that the left knee was hot and fluctuating, not red, having all the local symptoms of acute synovitis, hereafter to be more minutely described. The same conditions continued for four days; on the fifth morning he died.

More than sufficient injury to account for death was found in the head by the gentleman who examined it. I made a careful observation of the knee.

The joint contained about an ounce and a half of synovia, which was slightly turbid, opalescent, and in which floated shreds of false membrane, some semi-transparent, others opaque and white: these latter being more evidently fibrous; one of the shreds was loosely attached by one end to the synovial membrane, the rest floating freely in the fluid. The whole membrane was intensely injected, the vessels not being on the surface, but as though visible through the film; in some parts the injection was much more violent than in others; the deepest in color were the fringes around the patella, the so-called alar ligaments, and the subcrural cul-de-sac; in many spots of these parts were actual extravasations, which, again, were not on the surface, but beneath a fine film. In the less injected parts of the membrane long tortuous vessels could be distinctly traced. The surface of the membrane itself was finely roughened; on holding it up and looking towards the light over the surface, it was seen to be covered with papilla-like or velvety elevations; it looked like the surface of the duodenum when the valvulæ conniventes are straightened out. The membrane was easily torn, and very easily stripped from the underlying tissue, which was highly injected and infiltrated by a turbid serum.

On the inner condyle of the femur was a spot as large as a sixpence, whence the cartilage had entirely disappeared; the edges of the ulcer were perfectly smooth, sharp, and clean. The rest of the cartilage was entirely healthy.

Although this is a very early examination of synovitis, yet the inflammation had advanced to the fourth day, and therefore the appearances observed are not to be regarded as those of commencing acute disease. It is impossible, or nearly so, that in the human subject we ever should have an opportunity of seeing its actual first attack; but there can be no doubt that its first visible sign is congestion of the subserous tissue. An old notion fixed, as the first effect of synovitis, dryness of the membrane; and I see, in a recent book on Joint Diseases, that its author, Mr. Bryant, of Guy's Hospital, still adheres to that idea. The theory, however, has no facts to support it, and was supposed to be set at rest by the experiments of M. Richet of the Hôpital Bons-Secours, of M. Bouley, of M. Rey, and of others, none of whom mention dryness as a result of artificially excited and carefully-watched synovitis. The first author indeed expressly denies its existence. He had opened, at different times, the joints of several dogs, and observed hour by hour the alterations taking place in the synovial membrane. He says:[1] "After ten hours the membrane lost its polish, but I never at any time could find that it was drier than in the normal condition—this dryness of the serous membranes in the first stage of inflammation is admitted by all authors, yet nothing is less proved, and it is to explain their crackling (bruit parcheminé) that this particular condition has been invented."

The first effect, then, of the inflammatory irritation is congestion of the subsynovial tissue, accompanied by rapid secretion of serous or thin synovial fluid into the joint. This congestion is most marked wherever that tissue is lax and abundant; wherever, on the contrary, it is scant, and binds the basement membrane tightly down, there but little congestive redness is perceptible: hence the loose folds overhanging the cartilage, described in the last chapter, are those where redness is most marked, and where extravasation most readily takes place. Of extravasation, it may be observed that it is always found more abundant, and always spread over a larger surface, the more rapid and destructive the course of the case, and that in the most rapid attacks the fluid poured into the cavity of the joint itself will be tinged with blood. The quantity of effusion into the joint varies very much, partly with the amount of inflammation, partly with its quality; sometimes the effusion will be sufficient to produce considerable distension of the joint, and thereby increase of pain of inflammation. With the quantity of effusion corresponds also the amount of hypertrophy of the synovial villi. In the normal state these are only large enough to prevent the membrane appearing quite smooth and polished, like the inside of an ordinary serous sac; in this acute inflammation they give the membrane a rough velvety appearance.

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[1] Richet sur les Tumeurs Blanches. Mémoires de l'Académie Royale de Médecine, tome xvii. A fuller account of M. Richet's experiments is given further on.

Very soon after the increase of effusion has commenced, the membrane becomes puffy and swollen; the epithelial layer falls off, leaves a bare surface, the effusion becomes more fibrinous, and often at the same time opalescent in character. Bits of false membrane or semi-detached shreds are found adhering to the inside of the sac, while similar, and also softer, shreds will be found floating in the fluid; sometimes these are very nearly colorless and transparent, frequently white and flocculent like pieces of wool. Some of these floating flocculi are formed upon the inner surface of the synovial membrane, and are afterwards detached; but many are solidified in the fluid by a sort of organic crystallization. Such pieces are occasionally precipitated upon the cartilages, where they adhere simply by virtue of their gummy consistence.

The false membranes, which form upon the inner surface of the synovial membrane, must not be supposed to be the cause of the thickening which that structure undergoes. Very soon after the effusion of fluid, the membrane and the periarticular tissues become thick and more or less tough; therefore, even if the false tissue could produce the thickening on the free surface, it could not cause that on the outside of the synovial sac; but if we make sections through the tissue we shall find that the whole thickening material is one and indissoluble. Beyond the point where the induration takes place there is more or less exudation of a thick yellow serum.

The following paragraphs are for those of my readers who are interested in points of minute pathology.

The effusion by an inflamed surface of a fluid capable of spontaneous coagulation is undoubted; some of this liquid coagulates on the spot whence it is poured forth, some of it is dissolved in the ordinary secretion of the membrane. The fluid is organizable lymph, and it is, if not actually eliminated by the white corpuscles of the blood (as I taught in 1854, and still think probable),[1] at least so influenced by them, that it contains germs of similar elements. It is upon these germs that the subsequent changes of the fluid depend. The formation of the false membranes and flocculi, from an effused fluid (coagulable lymph), must not be confounded with another much more important process. It is, I believe, rare, except in rheumatic inflammations, that a fibrinous effusion proper remains permanently adherent to, and becomes vascularized on a synovial surface. Thickening from such cause could affect such surface only, whereas we know that all the periarticular tissues are thickened, for coagulable lymph is never effused except on a free surface as of a cavity or of a wound; thickening, solidification, and repair of injury in the substance of a tissue, take place by another action. This process may be called granulation, as it is precisely similar to that which occurs in a wound healing by the second intention, or in an old abscess which is filling up. It consists in a growth, at both sides of the basement membrane, of nucleated, round, and oval cells. Those which sprout from the free surface increase the size of the villi, and give the membrane a velvety look, and as they grow they gradually push off any false membranes that have consolidated on the surface.[2] This growth is not an exudation nor an effusion; it is not a material fluid at first which subsequently becomes solid, but it is a true growth commencing at once by the sprouting of cells from germs originally in the tissue. The growth that takes place on the attached side of the basement membrane is precisely similar, consisting of round and oval nucleated cells, which fill up the meshes of the subareolar tissue, and produce the solidification which always accompanies synovitis. Between these two new growths of cells the basement membrane of the synovial structure is lost; the whole seeming a thickened mass which, as the case goes on, becomes more fibrous and tough; but while the inflammation lasts the new layers of the thickening (therefore the most internal and the most external) plainly show cellular consistence. The parts of the tissue further away from the focus of inflammation are infiltrated by a yellow serum. It follows, when the cell-growth from the inner aspect is pretty considerable, that the internal surface becomes wavy or nodulated; it first masses together, concealing the villi, and it is evident from our description of the ligaments and their continuousness with the other fibrous tissues around the joint, that when the inflammation spreads sufficiently far outwards from the centre these become involved.[1]

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[1] See Barwell on Strong and Weak Inflammations. Medical Times and Gazette, June 23, 1854, et seq.

[2] This is generally, but not always, the case.

At some part of this stage of effusion and thickening most cases of simple synovitis stop, either checked by treatment or by the natural limits of the disease. Such is usually the case with simple synovitis, synovitis from pyæmia,[2] and acute rheumatism;[3] the cartilages have not been affected, for they reply more slowly to an irritation than do textures which are supplied with bloodvessels and nerves; the ligaments in far advanced instances are somewhat altered, being thickened, and the fibres separated. The above described processes diminish first in intensity, then cease; then commences retrogression, the engorgement disappears, and the superabundant fluid in the joint decreases in quantity. The granulations shrivel, are in part absorbed and partly converted into imperfect areolar tissue, which remains like an old scar, causing some thickening, with loss of pliability and of elasticity in the periarticular tissues. If the amount of fluid poured forth during the disease have been large, it will have caused such distension of the synovial membrane that the latter will perhaps never, and certainly only after a lapse of time, regain its normal dimensions, and in its cavity the synovia will remain rather more abundant than natural. From these causes the joint does not recover its original size; if it be superficial the increase will be plainly perceptible; moreover it will feel stiff and weak for years after the disease, being extremely liable to renewed attacks of inflammation. It may also be left subject to painful sensations which seem to depend on, or at least to be greatly influenced by every change of weather, and which gradually disappear unless the patient be advanced in life, or of a rheumatic constitution.

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[1] For a further account of this process, see the Pathology of Strumous Synovitis.

[2] See Chap. III.

[3] See Chap. IV.

Suppurative Synovitis.—In many cases, however, and particularly in those that result from a wound, and also in the worse forms of pyæmia, many more advanced and injurious actions take place; and we may at once quote the summary of M. Richet's experiments to point out the succession of morbid actions in such cases:—

> "Having opened a joint in several dogs, and sometimes several joints of the same dog, I was enabled to establish the following facts; but not without difficulty, owing to the extreme agitation of the animals and to the small extent of their synovial membranes.
>
> "The membrane, either exposed or touched with some irritating liquid, could be seen after the lapse of from four to six hours to become reddened, the redness appearing to belong more particularly to the subserous tissue.
>
> "After ten hours the membrane lost its polish, but I never at any time could find that it was drier than in the normal condition. This dryness of the serous membranes in the first stage of their inflammation is admitted by all authors, and yet nothing is further from proof. This peculiar state, which has never been shown by direct observation to exist, has been invented to explain their crackling (bruit parcheminé). May this not be explained by the loss of polish, itself determined by the falling away of its epithelial layer? or, to speak more clearly, may it not be caused by the loss of their habitual flexible condition? On the next day the redness appeared more superficial, and more particularly as though distributed in patches resembling spots of ecchymosis. The serous surface was dull, and covered by a sero-sanguinolent layer, which soon became more abundant. After forty-eight hours the synovia became thicker, and assumed the color of wine-lees; the synovial membrane beneath this began to get granular.
>
> "On the third day, real but badly-formed pus flowed from the wound; the synovial membrane at this time was nearly uniformly red. There was much sanguineous congestion in the neighboring tissues, and when the synovial surface had been well wiped with a piece of linen, there were seen, on looking against the light, fine granulations, which I would compare to those observed on the inner surface of the eyelids in old blepharitis, but they were more marked. During the following days all these appearances increased, and from the fifth to the twelfth day was observed upon the surface of the synovial membrane a pseudo-membranous exudation, which seemed to me to form intimate adhesions with the granulations above described. At a later period the synovial membrane could be seen to swell, to form a fringe, a true chemosis, round the cartilages, which, in the midst of all this disorder, preserved their normal whiteness.
>
> "In one case, when I killed the animal sixty-three days after having injected pure alcohol into his synovial membrane, causing thereby a freely suppurating inflammation with neighboring abscesses, I found these synovial fringes encroaching so greatly upon the cartilaginous surfaces as almost to

conceal them; nevertheless they could be displaced by the end of the finger; and then it was perceived that they not only had contracted no adhesions to the cartilage, but also that these latter had suffered no change, except a slight loss of brilliancy, and that they were thinner than natural."

This account, as far as it goes, may certainly be accepted as representing a good view of the actions taking place in traumatic synovitis, although these cases are excessive. But in the human being blood is not so constantly nor so largely mixed with the synovia as these experiments would lead us to suppose is the case with animals, and pus is much more readily formed.

The fluid, at first poured into the joint over-abundantly by the simple inflammatory exaggeration of its usual function, is clear synovia; this gradually becomes turbid and more fibrinous, some of the fibrin may coagulate into a semi-transparent jelly, in a little time the opalescence increases, and now the coagulated fibrin is white, opaque, and flocculent, and in time the fluid in the joint is pure pus.

Thus, if there be no specific mark of the pus-cell (see p. 57), so is there no sharp boundary between a liquor rendered turbid by their presence, and pure pus; there exist, on the contrary, innumerable fine gradations; and in watching a case of traumatic synovitis, the surgeon will observe that the fluid poured forth from the wound becomes more and more turbid, and loses gradually the threadiness of synovia, and then becomes pus; but between the two pure liquors lie many stages in which he will not be able to name the discharge either one or the other. While these changes in the quality of the discharge are going on, and rarely in acute synovitis before pus is formed in the joint cavity, the cartilages participate in the disease: they begin to ulcerate. This action commences on the superficial surface, and spreads deeper to the attached surface of the cartilage: the earliest perceptible sign of this process is a loss of the smoothness and translucency of the surface, and its color becomes of a dead or opaque whitish yellow. Such change occurs in spots, at first small, but gradually increasing; soon afterwards these spots either become simple holes, or they first become thready and fibrous, and then erosions with velvety edges. The former is the most rapid form of the action, and it leaves ulcers with sharp defined edges, "looking as though they had been cut out with a chisel." (Sir B. Brodie, *Diseases of the Joints,* chap. v. p. 64.) The latter is a slower form, and the ulcer thereby produced has a peculiar appearance, being lined at its side and bottom by fibrous walls of velvety consistence. Sometimes, in suppurative synovitis, these ulcers are very small and numerous, the cartilage looks "worm-eaten." Ultimately the ulcerations reach the bone, and this structure becomes involved; they then spread even more rapidly, so that on examination of such a joint we may find the bone laid entirely bare or only covered here and there by thinned, irregular-shaped, and jagged-edged pieces of softened cartilage. If the bone be split open, all that part which underlies the articular lamella will be found gorged with blood, and much redder than normal—as I have found at post-mortem examinations by comparing the fellow bone.

We will examine these processes more minutely:—

When previously describing the formation of pus in a joint, it was remarked that the synovia became opalescent and turbid by suspension therein of a number of cells, nuclei, and exudation-corpuscles. When the action is very intense, the first two of these constituents, besides being produced in large quantities, multiply very considerably, and render the fluid thick, cream-colored, and opaque—in fact, puriform. The formation of these bodies in quantities so innumerable is a subject worthy inquiry, and which has, indeed, excited the attention of pathologists even from the moment when the pus-cell was first discovered, although it is only of late years that the true signification of them has been defined. The pus-cell, as Rokitansky observes (*Lehrbuch der Pathologischen Anatomie,* 3te Auflage, bd. i. s. 136), is not a body differing, specifically, from every other cell; and therefore it is not right sharply to separate pus from those neoplasms which have a solid intercellular material. Paget considers this cell as a degenerated granulation cell, and, to a certain degree, he is right; for, when the normal cells of the synovial and subsynovial tissue take on the action which produces the granulation above described, a quantity of these overstep the amount of multiplication necessary, and assume a development of multinucleated granular cells, which are true pus-cells, and which, poured in great quantities into the joint with the fluid surrounding them, fill the cavity with pus.[1] But this is not the only source of pus in joints, for while the action in question is going on in the membrane, the cartilages, it has been said, begin to ulcerate. This ulceration of cartilage consists in an exaggerated growth of cells, commencing at the free surface and penetrating deeper and deeper. The cartilage-corpuscles and their cells, in a normal state, diminish as they proceed from the attached to the free aspect, but a section through ulcerating cartilage shows that at a certain distance from the deep surface, *i. e.*, as far as the irritation reaches, these cells, instead of becoming smaller, suddenly assume an exaggerated growth, become not only larger in size but in quantity, and distend the corpuscle inordinately. In an advanced condition these bodies contain not merely four or six cells, as in their normal state, but an indefinite number of brood-cells, multinucleated cells, and bare nuclei; and they frequently burst, setting these matters free. (See *Redfern on Abnormal Nutrition of Articular Cartilages.*) At this time the last layer or two of cells, which normally are dry and flattened scales, therefore incapable of further action, become detached, and may fall off one by one, or in little membrane-like pieces into the joint cavity. If an articular cartilage be examined at that period when the cells have first commenced the above-described superabundant growth, portions of this layer of flattened cells may be stripped off like a membrane, have indeed been mistaken for one; but a careful examination will show its true nature. The disease must be caught at a particular phase, that this membrane-like detachment of the last layer of cells may be found. The great increase of cell-action, overstepping the limits of nutrient power, is fed by the hyaline substance, which it eats up bodily in the most rapid forms of disease; and in the slower, converts it first into fibres by devouring only parts in parallel lines in the direction of the cell-growth. The large cells press to the surface, as in normal cartilage, but more quickly, and many of the corpuscles burst on the free surface, leaving crater-like chasms behind, which add to the roughness of the fibrous ulcer. The cells are thus set free in a state of great generative activity into the cavity, where they mingle with, are, in fact, undistinguishable from the pus-cell, and multiply as it does. The amount of pus thus formed from the cartilage-cells is considerable, and shares the purulent action with the cells from the granulation tissue, as already described.[1]

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[1] **Virchow's Cellular Pathologie, s. 395. Weber, in Virchow's Archiv., Bd. xv., heft 6, s. 465. 1859.**

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[1] Virchow's Parenchymatöse Entzündung., Archiv., Bd. iv., h. 3, s. 234; Weber über Entstehung des Eiters (1859), Archiv., Bd. xv., h. 6, s. 467; and many other

The ulceration in the cartilage, which proceeds in reality from an inflammation (see Chapter V.) makes, like all other inflammations, increased demands for pabulum; hence the vessels situated beneath the articular lamella become hyperæmic. In a short time the inflammation spreads to the bony tissue, caries commences, and granulation in the spongy texture of the bone. Those parts of the cartilage which have not yielded to ulceration are now in great measure deprived of nutriment, and fall into fatty degeneration. The suppuration and destruction of the bone spread more and more; abscesses form in the periarticular tissues, among the muscles far from the joint. The pain is most severe, particularly at night, and at last the patient is so worn that death or amputation becomes inevitable.

This sketch is, of course, taken from the worst and most intractable form of cases. In many instances a carefully planned treatment, aided by a strong constitution, may prevent the excess of suppuration and the spreading of destructive action, and at last succeed in saving both limb and life.

SYMPTOMS.

The symptoms of this disease are, of course, those of inflammation—pain, heat, redness, swelling; but there is another peculiar to them as joints—position. We will examine the first three symptoms by themselves because they are so alike in all places that very little need be said for each particular joint, but the swelling and the position differ so much for each articulation, that a description of them in the more important parts is a necessity.

When the disease has been produced by violence, the pain at the moment does not disappear entirely; it may even become, during a certain space of time, less and less severe, but a sense of weight and inability to move remains: this is followed by an increase in the pain, perhaps by throbbing, and as the disease becomes established the suffering is frequently severe. Where the attack arises from exposure, the patient is generally awoke in the night by pain. It is sometimes described as being like an internal bruise, some-

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papers in the same periodical. Bilroth, Beiträge zur Pathologischen Anatomie. Rokitansky, Lehrbuch der Pathologischen Anatomie, 3te auflage, s. 136. Paget's Lectures, Surgical Pathology, vol. i. p. 231, &c. &c.

times as though hot iron were in the bone. In other instances a sensation of great distension is the chief complaint, the patient affirming that he feels as though a crowbar were between the bones with which the joints were being forced asunder. The pain in certain joints passes also to other parts of the limb: thus, synovitis of the elbow produces pain running down the arm to the little finger, and sometimes, but less frequently, to the back of the thumb and index. When the disease is situated in the hip, it causes also pain in the knee.

Heat is a constant symptom, even when the disease is situated as far from the surface as the hip; but the heat, in different cases, is not only different in degree but to a certain extent in kind. When a surgeon places his hand over a knee suffering from simple synovitis, he will find it hot; if it be a traumatic case in the early stage, still hotter; but the heat will not appear very near the hand; the skin itself seems as though it were not so hot as is a deeper-lying structure: but if we take a case of acute rheumatism, the heat may or may not be greater, but it comes immediately next the hand; it is quite superficial. In pyæmic and gonorrhœal cases, on the contrary, there is not generally so much heat as in simple synovitis; in fact, the whole skin of the body is hot, but the joint wherein the pain is situated appears hardly, if at all, hotter than other parts.

The redness varies in a very similar manner: in acute rheumatism the joints attacked are very red; in simple synovitis they are only slightly reddened. The pyæmic and gonorrhœal form do not cause any redness of the skin at all;[1] indeed I have sometimes thought that the joint was actually whiter, more pallid than its fellow.

The swelling is caused by increased secretion into the synovial sac, and partly, though to a less degree, by the hyperæmia and effusion into the surrounding tissues. In forming a diagnosis of the case, however, it is necessary that the surgeon should convince himself that the fluid tumefaction, which his practised hand readily discovers, be really in the synovial membrane, and not in any neighboring bursa or other part. To do this he must be acquainted with the shape and circumstances of the synovial enlargement; the membrane is bound down in all joints by ligaments and by tendons, which, in the natural condition of parts, are prominent;

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[1] The skin over inflamed superficial veins and absorbents is excepted.

but when it is pressed outward by a force from within, these bands resist the pressure, and they become either concealed or form depressions: hence is a rather different anatomy of the swelling for every joint, according to the positions of ligament and tendon crossing it.

The position which a limb assumes when one of its joints becomes the seat of acute disease, is very important, not merely as a diagnostic sign, but also as a point which can be made useful in treatment. Every joint, when it becomes inflamed, assumes a certain position as surely as it becomes congested and hot; and in this position only can the patient obtain anything like ease. Many reasons have been assigned for this invariability of posture, and among others that the particular position assumed by each joint is that in which its synovial membrane acquires the largest capacity, and therefore that in which the effused fluid would exercise the least pressure. In order to prove this, as well as to settle some other points, M. A. Bonnet,[1] of Lyons, made some experiments on the dead subject, by the forcible injection of fluids into all the large joint cavities, and observing the positions which the parts assumed. He gives a very detailed account of these experiments, not only in general, but in each particular case, which renders it far too long to quote here; but the gross results, taken in connection with clinical experience, are interesting. It is well to premise, that when the synovial membrane of a joint was forcibly injected by M. Bonnet the limb always assumed the same position, whatever might have been its posture before the injection was made. This position of the joint is that which allows the greatest possible capacity to the synovial membrane; as is proved by the fact that when the membrane is tense forcible change in the position of the limb causes its rupture.

The Shoulder.—The deltoid looks a little fuller than natural; the broad groove running downward from the acromion, and separating the chest from the shoulder, is in great measure obliterated or rendered narrower; likewise the depression at the back below the acromion is lost; the axilla is also shallower, and when the surgeon places his finger in that cavity, and presses upward and outward, pain is experienced.

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ı which a limb assumes when one of its joints becomes ute disease, is very important, not merely as a diag- ıt also as a point which can be made useful in treat- joint, when it becomes inflamed, assumes a certain rely as it becomes congested and hot; and in this can the patient obtain anything like ease. Many been assigned for this invariability of posture, and that the particular position assumed by each joint is its synovial membrane acquires the largest capacity, that in which the effused fluid would exercise the . In order to prove this, as well as to settle some M. A. Bonnet,[1] of Lyons, made some experiments on ect, by the forcible injection of fluids into all the large and observing the positions which the parts assumed. ry detailed account of these experiments, not only in n each particular case, which renders it far too long e; but the gross results, taken in connection with ience, are interesting. It is well to premise, that when membrane of a joint was forcibly injected by M. Bon- always assumed the same position, whatever might posture before the injection was made. This position s that which allows the greatest possible capacity to membrane; as is proved by the fact that when the tense forcible change in the position of the limb causes

ler.—The deltoid looks a little fuller than natural; the running downward from the acromion, and separating m the shoulder, is in great measure obliterated or ren- wer; likewise the depression at the back below the lost; the axilla is also shallower, and when the surgeon ıger in that cavity, and presses upward and outward, rienced.

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[1] lies des Articulations," by A. Bonnet. Paris, Baillière, 1845, p. 50,

times as though hot iron were in the bone. In other instances a sensation of great distension is the chief complaint, the patient affirming that he feels as though a crowbar were between the bones with which the joints were being forced asunder. The pain in certain joints passes also to other parts of the limb: thus, synovitis of the elbow produces pain running down the arm to the little finger, and sometimes, but less frequently, to the back of the thumb and index. When the disease is situated in the hip, it causes also pain in the knee.

Heat is a constant symptom, even when the disease is situated as far from the surface as the hip; but the heat, in different cases, is not only different in degree but to a certain extent in kind. When a surgeon places his hand over a knee suffering from simple synovitis, he will find it hot; if it be a traumatic case in the early stage, still hotter; but the heat will not appear very near the hand; the skin itself seems as though it were not so hot as is a deeper-lying structure: but if we take a case of acute rheumatism, the heat may or may not be greater, but it comes immediately next the hand; it is quite superficial. In pyæmic and gonorrhœal cases, on the contrary, there is not generally so much heat as in simple synovitis; in fact, the whole skin of the body is hot, but the joint wherein the pain is situated appears hardly, if at all, hotter than other parts.

The redness varies in a very similar manner: in acute rheumatism the joints attacked are very red; in simple synovitis they are only slightly reddened. The pyæmic and gonorrhœal form do not cause any redness of the skin at all;[1] indeed I have sometimes thought that the joint was actually whiter, more pallid than its fellow.

The swelling is caused by increased secretion into the synovial sac, and partly, though to a less degree, by the hyperæmia and effusion into the surrounding tissues. In forming a diagnosis of the case, however, it is necessary that the surgeon should convince himself that the fluid tumefaction, which his practised hand readily discovers, be really in the synovial membrane, and not in any neighboring bursa or other part. To do this he must be acquainted with the shape and circumstances of the synovial enlargement; the membrane is bound down in all joints by ligaments and by tendons, which, in the natural condition of parts, are prominent;

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[1] The skin over inflamed superficial veins and absorbents is excepted.

but when it is pressed outward by a force from within, these bands resist the pressure, and they become either concealed or form depressions: hence is a rather different anatomy of the swelling for every joint, according to the positions of ligament and tendon crossing it.

The position which a limb assumes when one of its joints becomes the seat of acute disease, is very important, not merely as a diagnostic sign, but also as a point which can be made useful in treatment. Every joint, when it becomes inflamed, assumes a certain position as surely as it becomes congested and hot; and in this position only can the patient obtain anything like ease. Many reasons have been assigned for this invariability of posture, and among others that the particular position assumed by each joint is that in which its synovial membrane acquires the largest capacity, and therefore that in which the effused fluid would exercise the least pressure. In order to prove this, as well as to settle some other points, M. A. Bonnet,[1] of Lyons, made some experiments on the dead subject, by the forcible injection of fluids into all the large joint cavities, and observing the positions which the parts assumed. He gives a very detailed account of these experiments, not only in general, but in each particular case, which renders it far too long to quote here; but the gross results, taken in connection with clinical experience, are interesting. It is well to premise, that when the synovial membrane of a joint was forcibly injected by M. Bonnet the limb always assumed the same position, whatever might have been its posture before the injection was made. This position of the joint is that which allows the greatest possible capacity to the synovial membrane; as is proved by the fact that when the membrane is tense forcible change in the position of the limb causes its rupture.

The Shoulder.—The deltoid looks a little fuller than natural; the broad groove running downward from the acromion, and separating the chest from the shoulder, is in great measure obliterated or rendered narrower; likewise the depression at the back below the acromion is lost; the axilla is also shallower, and when the surgeon places his finger in that cavity, and presses upward and outward, pain is experienced.

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[1] See "Maladies des Articulations," by A. Bonnet. Paris, Baillière, 1845, p. 50, &c. &c.

The position which the patient, while sitting or standing, assumes —that which I would call the characteristic position—is to hold the elbow in the sound hand, keeping it a little in front of the body and away from the side. M. Bonnet[1] found, on forcibly injecting the joint, that the humerus was abducted till it formed with the ribs an angle of 35°, at the same time it was carried forwards. Sometimes the bursa under the deltoid muscle becomes inflamed and swollen; this affection renders the deltoid more prominent than is the case in synovitis, and the other signs are absent; a crackling, a fluid crepitus also is felt in the bursal affection which is absent in the synovial disease.

The Elbow.—At the back of this joint are two depressions, one on each side the triceps, tendon, and olecranon process; the lower part of the outer of these contains the junction between the head of the radius and the humerus, which, in the natural condition of parts, may easily be felt. When the elbow-joint is the seat of synovitis these depressions are obliterated, the synovial membrane rises high beneath the triceps tendon, and can be made to fluctuate from one side to the other beneath it; the depression that should be felt between the radius and humerus is exchanged for a fluid enlargement; the depression also between the olecranon and internal condyle is in the same condition. Viewed from the front the joint looks broader than natural.

The characteristic position, is with the fore-arm bent at a little more than a right angle on the upper arm, and the hand in a position which places the thumb upwards; the patient usually holding the wrist in his sound hand. Bonnet says, under the influence of forced injection the ulna is always brought to stand at nearly a right angle to the humerus, and at the same time the radius takes a position between pronation and supination.

The Wrist.—Round the back of this joint there runs, in acute synovitis, a bracelet-like swelling, which is more marked laterally, on either side of the extensors of the fingers, and between the extensor ossis, metacarpi, and extensors primi and secundi internodii pollicis; in front also, at either side the flexor tendons, it is perceptible. It cannot be mistaken for enlargement of tendinous sheaths, for these behind are very superficial, generally bi- or trificureated and fusiform, the long axis being parallel with that of the arm, not, as in synovitis, at right angles with it; in front enlargement of the large tendinous sheath produces swelling in the palm and wrist—a bisaculated swelling.

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[1] Op. cit., vol. ii. p. 549.

The Hip.—It is more difficult on account of the depth of this joint to distinguish the swelling produced by acute synovitis. The tumefaction is to be seen and felt in the groin below Poupart's ligament, and also behind the great trochanter—the natural depression in this place is more or less obliterated. When the fluid is large in quantity some swelling may be felt on the inner side of the thigh, where it joins the perineum. The pain, which in this complaint is often very intense, is chiefly referred to that part of the thigh, and more rarely to the knee, as in chronic hip disease. Generally the limb appears lengthened, and is a little flexed, abducted, and rotated slightly outwards.

The characteristic position is this; the thigh is bent on the pelvis, a little abducted and rotated outwards. In reclining, the patient usually lies on the affected side, the knee drawn up to about 120° with the body. While sitting, the patient may be seen leaning with the elbow on the sound thigh, holding the knee of the affected limb in his hands, and supporting that foot across the foot of the other limb. M. Bonnet[1] says that a forced injection causes the femur to bend at an obtuse angle to the pelvic axis, at the same time it becomes abducted and rotated slightly outwards.

Two bursæ about the hip-joint may by their enlargement give rise to symptoms, which would lead a careless observer astray. One beneath the gluteus maximus muscle would, when inflamed, produce behind the trochanter tumefaction similar to that caused by joint inflammation; but the swelling is diffused over a larger circumference; it is not merely behind, but is also above and superficial to the trochanter; it crackles on movement of the part; moreover, in such a malady no inguinal enlargement is produced. Between the conjoined tendon of the psoas and iliacus muscles and the bone is a bursa, which sometimes, though rarely, becomes inflamed; in this case the swelling and tenderness in the groin will be hardly distinguishable from that of joint disease; but there is no swelling behind the trochanter. Moreover, although when the hip-joint is inflamed, certain positions are, as already pointed out, less painful than others, yet the difference is not nearly so great as it is in inflammation of this bursa. If, in such a case, the thigh be straightened on the pelvis, and rotated a little inward, the pain is intense; but if the thigh be much bent towards the abdomen, turned a little outward and supported in this position, the part is quite at ease. Thus, inflammation of either of these bursæ is easily to be distinguished from synovitis of the hip-joint; but it is right to state that the psoas bursa and synovial sac sometimes, though rarely, communicate, as the synovial membrane of the shoulder sometimes communicates with the bursa beneath the deltoid.

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[1] Op. cit., vol. ii. 261.

At the knee synovitis is very easily distinguishable on account of the superficial position of the joint. The shape of the part becomes altogether altered, the natural depressions are filled up, the elevations concealed, so that the whole looks like a bag bound in at the sides by the lateral ligament; for instance, the patella and its ligament, instead of presenting a prominence bounded by lateral depressions, lie in the midst of a puffy tumefaction, being almost concealed by the bulging out of the synovial bag at their sides. On each side of the patella and its ligament, the swellings thus caused may be felt distinctly to fluctuate from one to the other; the patella itself is buoyed up or pushed away from the femur; it floats and rocks upon the accumulated fluid beneath; by slight pressure it may be pushed back into its place between the femoral condyles, and may be felt to strike against them with a gentle impulse. The fluid swelling rises up between the bone and the extensor muscles, whither the synovial membrane, often even in a healthy state, and always in this disease, extends very high. When the secretion is rather large in quantity it causes also fulness of the popliteal space.

The position of the joint is semiflexed at about an angle of 120°. M. Bonnet[1] found also that forced injections into the synovial membrane placed the bones in this position.

Two bursæ are situated in front of the knee-joint, a large one between the patella and skin, a small one between the ligamentum patellæ and the tibia above the tuberosity; this latter sometimes communicates with the joint. It is scarcely conceivable how inflammation of either of these can be mistaken for synovitis of the knee. The former bursa, when inflamed, causes a very prominent swelling over the patella, rendering this region markedly protuberant, while in synovitis it becomes concealed and less prominent. Inflammation of the latter bursa produces but little swelling, which is just on each side the upper part of the tibial tuberosity, but it never rises high enough to be mistaken for knee-joint disease, and the seat of swelling and of pain is much more limited.

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[1] Op. cit., vol. ii. p. 152.

At the ankle the swelling lies in front in a half circle extending from malleolus to malleolus, and also behind these processes of bone. Fluctuation may be felt from one to the other without difficulty when the effusion is pretty considerable.

Acute synovitis of this form is always accompanied by inflammatory fever according to the amount of the inflammation, and to the size and importance of the joint. When it occurs at the hip and shoulder (rare cases), particularly at the former, this disturbance is well marked.

The symptoms which indicate suppuration in the joint are obscure as long as no opening enables the surgeon to see whether pure pus or turbid synovia be flowing away. The surgeon's finger detects the presence of fluid, but does not inform him of its nature, and therefore he must judge by other and more general signs. If the patient have, during the inflammatory attack, a *rigor* followed by more intense pain in the joint and by greater feverishness; if the skin of the part become more red and the effusion into the periarticular tissues more considerable, so that the tumor lose some of the characteristic marks above mentioned, and become more round and shapeless, the probability is that pus is being formed. It is to be observed that it is not the mere presence of pus, which we wish to distinguish as an important point, but rather the pus-producing inflammation from one less violent and injurious. The pus itself is not physically different to synovia, or other fluid, its presence therefore cannot be directly diagnosed, but the violent and hasty inflammation which produces pus is destructive, and has certain characteristics which may be easily distinguished. The general symptoms are those whereby we can chiefly judge the presence of this matter. After the rigor above mentioned has occurred, the fever from which the patient suffered will change from the inflammatory type to a depressed or typhoid character.

The pulse does not diminish, probably increases in rapidity, and becomes small, the face is drawn and anxious, the eyes dull and heavy, the tongue brown, furred, and dry; in fact he will suffer the symptoms for which we may safely refer to general surgery under the name of typhoid, or low fever.

The purulent inflammation does not continue long without involving the periarticular tissues as well as the mere cavity; all the parts around the joint, ligaments, and areolar tissue, become softened; abscesses form in them, which are generally in communication with the joint; these may be felt as nearer to the surface than the rest of the fluid; and after a time, if the case go on long enough, they will point. Soon the skin gives way at these spots, and openings into the joint are formed from which pus, sometimes pure, sometimes tinged with blood, occasionally of a brownish color and fetid, will plentifully flow. The joint, on account of the loosening of the ligaments, will be movable in abnormal directions—for instance, the tibia can be rotated on the femur. As the cartilages will by this time have disappeared in great part or altogether, the bones of the joint can be felt to grate together. At last the whole limb swells and becomes œdematous, abscesses form among the muscles even at considerable distances from the joint.

The patient by this time is reduced to the last degree, he is delirious at times, has lost all appetite, sweats profusely, has diarrhœa, and other symptoms of the worst typhoid character.

The pain is intense, indeed the most horrible tortures of which humanity is capable are produced by this disease, yet great as all these evils are they may be complicated by another, viz., pyæmia.

TREATMENT.

The treatment must be divided into general and local. An acute inflammation has an effect upon the general system, and through the system may be itself affected. The remedies belong to the class called antiphlogistic. Among these are General Bleeding, Purgatives, Diuretics, Mercury, and Antimony. The first of these, bleeding, need very seldom indeed be resorted to; the second is valuable; at first a slight mercurial, followed by a hydragogue cathartic, has great power in diminishing the fever, and may advantageously be followed by diuretics and diaphoretics. Mercury, if the local inflammation run high, is of avail in persons of a strong constitution; it may even, if necessary, be pushed till it touch the gums; but in those of a strumous habit its use should be limited and carefully watched. In these persons I prefer antimony; I have seen very beneficial results from its employment, and it is devoid of the danger which mercury involves. Antimony and nitrate of potash will together be sufficient to keep down the inflammatory condition in most cases; and, when aided by local means, have a marked effect in subduing acute synovitis. One caution, however, in the employment of all lowering medicines is very necessary, namely, that they must not be pushed to the point of producing debility, for when that state comes on, suppurative inflammation may be induced.

A point well worthy of consideration is the pain and the injury it may do. Pain is an evil in itself, from which every surgeon is bound to save his patient, as far as possible; but it is besides, I am convinced, a cause, when it lasts, of additional diseased action: it is a direct irritant. Thus, if the patient, in spite of all the local means which can be employed, nevertheless suffer severe pain, this evil ought to be subdued by opium, or if that drug, from any idiosyncrasy, be inadmissible, by other anodynes or narcotics. Much praise is due to a combination in these cases of antimony and opium. The antimony, by depressing the heart's action, or promoting absorption, or both, enables the other drug to act much more readily, and therefore smaller quantities may be given; the effect of such a prescription is often very marked. The value of calomel and opium need hardly be mentioned, indeed upon this combination many surgeons depend for the treatment of all acute inflammations.

Of the local means perfect fixity of the part is the most important. It has already been mentioned that the synovial membrane is more capacious in certain positions of the joints than in others, and in a state of inflammation, when the membrane is filled with fluid, that position will be nearly always the one chosen. But this posture is not always that which is most favorable for treatment. Thus the knee will naturally assume too bent a position, and it must be confined in a straighter posture than it would itself assume. I put the limb on a straight splint at the back; but it is necessary, in so disposing it, to place a rather thick pad under the popliteal region, otherwise considerable pain will be produced. It is to be remarked that the joint below the affected one should also be confined. Thus, in fixing the shoulder, not only should the upper but also the forearm be fastened to the side, otherwise rotation of the joint will not be prevented. In fixing the elbow, the wrist must also be confined, or supination and pronation can take place, and so on. The splint, therefore, must be long enough to include both articulations. Leather or pasteboard is preferable to gutta percha, particularly for children, as this last confines the cutaneous secretions. The splint for the knee should be stiffer. I prefer, as above said, a wooden splint at the back.

Local depletion by the cupping-glass, or by leeches, is very valuable; but in superficial joints, as the knee, neither should be applied immediately over the synovial membrane: I have seen ill effects follow the neglect of this rule; they should be placed above the joint, i. e., between it and the heart. In dealing with deeper joints as the hip and shoulder, the application may be made as close to the part as possible. It is better not to abstract any large quantity of blood at once; the amount will of course depend on the age and constitution of the patient: young children very rarely, if ever, require this remedy for a synovitis; and even a strong man should not lose more at a time (locally) than from four to eight ounces, either by cupping or by the application of from eight to twelve leeches; the remedy may, however, be reiterated. A caution respecting the repetition of local bleeding is desirable: for there comes a time when it may be injurious; a time when the morbid condition ceases to depend so much on activity of the tissues as on a loss of contractility, a tropical asthenia of the bloodvessels. Locally this condition is accompanied by a cessation or great diminution of heat, probably also of pain, while the swelling continues, and the redness assumes a duskier hue, wherein pressure of the finger leaves a white spot more durable than while active inflammation continues. At the same time the symptomatic fever has much declined, or has assumed a more irritable and less sthenic type.

Hot fomentations and poultices, which greatly relieve during the first part of the disease, have also this effect upon the vessels, though in a less marked degree; hence their action also requires watching.

If the disease have reached this stage the treatment must be changed; with the change of type, tonics, steel, acids, and quinine are extremely useful—the opium may be diminished, then discontinued. Locally, the best applications are cold and pressure, if this latter can be borne, which is the case if there be no longer active inflammation. It is very useful to mark how to judge whether or no pressure is available. A certain point of each joint is observed to be always the seat of the most severe pain; if on pressing upon this spot no, or very slight, tenderness be felt, tight bandaging will not only be painless but actually pleasurable. These spots are mentioned in another chapter.[1] The bandage may be kept cold with an evaporating lotion, or with iced water.

Generally, however, the joint, instead of falling into this condition, may lose all its acute symptoms and suffer from a lingering inflammation of the subacute or chronic form. Counter irritation by means of blisters, or iodine, the iodide of potass ointment, Sir B. Brodie's acid lotion,[2] or other means will be sufficient to subdue this, if no constitutional state keep up the irritation, in which case the disease falls under another heading.

When this last condition is subdued, friction with motion (at first passive and then active) should be resorted to in order to promote absorption of the new growths. The former of these is very valuable for superficial joints, and often restores flexibility and perfect shape to the part more rapidly than any other means with which I am acquainted. It should be applied with the bare hand, but a little flour, starch, or oxide of zinc, may be used to protect the skin. Active motion should not be allowed as long as the points above mentioned remain tender. If the disease be in a joint of the lower extremity its use must be still further postponed, and even when first given up to the patient's management should be protected by tight strapping.

I have deferred making mention of a treatment that has been much recommended when the effusion is large in quantity, namely, subcutaneous incision of the synovial membrane; for it has not fallen to my lot to be driven to such a resource. It is founded on the idea that the tension of the sac prolongs inflammation, and there is no doubt that such may be the case when the fluid greatly distends the membrane. A tenotomy knife passed under the skin may be easily made to incise the sac to a considerable extent, the fluid then flows out into the areolar tissue, whence it will be absorbed. If care be taken to exclude air, no suppuration will follow this little operation, and it is quite credible that the inflammation would be more manageable when all tension has ceased.

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[1] See Chapter V., Treatment of Strumous Synovitis. Shoulder; in front below the acromion: elbow; at the back just above the head of the radius: wrist; at the back outside flexor indicis: hip; behind trochanter: knee; a spot on the femur midway between patella and internal lateral ligament: ankle; in front of outer malleolus.

[2] Acidi sulphurici fort ʒiss.; Olei olivi ℥iss; Olei terebinth. ℥ss.

In a case whose symptoms warranted this treatment, I should not hesitate to put it in practice.

Acute suppurative synovitis, whether or not resulting from a wound, requires a few words. It is certain that an opening freely admitting air into the joint cavity will produce suppurative synovitis; but the same disease will follow an injury without wound, and even idiopathic synovitis; while on the other hand all surgeons must have seen cases of wounds into joints, which were not followed by any evil symptom. This partly depends upon the form and size of the wound, upon its rapid closure, and very much upon the state of the person's health at the time. A wide gaping wound into the joint, allowed to remain open, will generally cause the disease; but sometimes a little wound will produce it, however well treated, while often a larger wound will not do so—for sometimes the health is in such a state that a suppurative inflammation will commence on the slightest provocation—while at other times wounds will heal, and injuries be recovered with marvellous rapidity.

CASE VII.—On the 14th March, 1859, I saw H. L., a young woman upon whose knee a boil had that morning been so incautiously incised, that it was feared the joint was opened; the circumstance leading to this suspicion was an escape of synovia. The boil was close to the ligamentum patellæ, close to and running parallel with which was an incised wound, a little more than an inch long, from which synovia oozed, and when the leg was bent flowed pretty freely. This flux proved nothing, since, although rather plentiful, it might be produced by the bursa in this situation. I therefore warmed, oiled, and carefully introduced a thin probe, when it sank at once to a depth clearly showing it to have entered the knee. The instrument was withdrawn, a gutta-percha splint placed on the limb, and the wound closed by painting its surface with collodion, and covering it with a piece of soap plaster; the object being not merely to prevent the entrance of air, but also the exit of synovia, which would tend to keep it open. The wound healed without a sign of synovial inflammation.

CASE VIII.—The following case was kindly sent me by my colleague, Mr. Canton.

Henry Short, sailor, ætat. 32, was sent to me on the 25th April, 1859. He came for ulcers about the right elbow, of which he gave the following account: Three years ago, while at sea between Madras and Calcutta, there broke out on board ship a complaint which he calls scurvy-boils; several of the crew were affected. He had several boils on different parts of his body, the worst being about his elbow, and nearly a fortnight after they had opened into an ulcer, the bone began to get bare. On his arrival at Calcutta he went into hospital, where the sore healed: he says that no bone came away; but in this he must be mistaken.

There is now a large scar, with uneven edges at the back of the elbow, upon which four small ulcerations have again appeared—one in the centre being deep and fistulous. Around this spot the elbow is deformed by a depression which, judging by eyesight, merely appears to result from absence of bone. On examining the part more closely by touch, it is evident that a portion of the olecranon is absent; the part still remaining is attached like a sesamoid bone to the triceps extensor tendon; between that detached piece and the rest of the ulna is an interval which corresponds to the depression above mentioned, and which varies from three-quarters of an inch, when the arm is straight, to one inch and a quarter when it is bent, and even to nearly two inches when the cubit is strongly flexed. In the centre of this space is the fistulous ulcer already described, out of which synovia flows freely. When he alternately bends and straightens the arm, rather quickly, air is sucked into, then driven out of this opening, with an evident impulse; and at the same time the synovial sac is first separated from, afterwards propelled against, the bones of the joint, making a flapping noise like the dry valve of a pump before the water has risen. When he had continued this action some time the joint looked a little swollen, and on pressing it with the hands air could be expelled from the synovial sac. The man experienced no pain nor any stiffness of the joint, and seemed surprised when told to keep it at rest.

The treatment was simply rest, closure of this opening by adhesive plaster, and the internal use of iodine. The ulcers gradually healed; that leading into the joint hardly slower than the others, because all flow of synovia was prevented. On the 30th May he was well, and about to start on another Indian voyage.

August, 1860. This man has returned: the ulcer into the joint is again open, but no inflammatory symptom has shown itself.

When a wound has been made into a joint, the chances of escaping suppuration are, *cæteris paribus*, proportioned to the time it remains open; it should therefore be instantly closed against all entrance of air, and kept at rest; the patient must be watched that the first signs of inflammation may be combated. It may be well, particularly if the bowels have been sluggish, to give some mild form of aperient at once, that in case inflammation begin one may have a day's start of it. The opium treatment comes again into consideration, and if now a patient were to come under my care with a wound of an important joint as yet uninflamed, he should probably be kept opiated for several days. I have known the most terrifying looking injuries—the prow of an outrigger run four and a half inches into a man's loins; a knife plunged into the abdomen, so that a wound of the stomach seemed a necessity; area railings run through a thigh—all treated by narcotizing—all get well without a bad symptom.[1] Locally, ice, or at least very cold water constantly renewed, is the very best application.

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[1] The first of these was under the care of my friend Dr. Julius, of Richmond; the second under that of my excellent colleague Mr. Hancock, to whom I owe many obligations; and the third under my own.

If inflammation set in, antiphlogistics may be used, but with the greatest caution; we are to expect suppuration, and we must husband our patient's strength to the utmost. I prefer as soon as this action has commenced, to give only salines to calm the fever; to put on poultices; use hot fomentations—do all that is possible to bring on the purulent stage, and its characteristic or suppurative type of fever, then to commence a stimulant and tonic treatment—wine, ammonia, quinine, the mineral acids, ethers, and a strong diet. Now, whether or not narcotism have been used, opium will be indispensable on account of the pain, which is atrocious. This stage of traumatic synovitis corresponds sufficiently with a non-traumatic attack which has become suppurative, and the following point in treatment becomes important. If the wound in the joint be small, or if there be no wound, shall the synovial sac be incised to let out the pus; or shall it be evacuated by a trocar; or shall it be let alone?

In a paper read by Mr. Gay before the Medical Society of London (*Medical Times and Gazette*, 1851, vol. xxiv. p. 546), that able surgeon recommends free incisions into the joint, on the plea that they allow shreds of cartilage, which may be shed into the cavity, to escape. It is for other reasons that I cordially commend the value of such treatment. Some French authorities, Petit, Boyer, and others, might also be quoted in favor of this plan. A joint once suppurated has lost that sensitiveness to the contact of air which it normally possesses: it is an abscess, and one cause of the great constitutional disturbance produced by the disease is confinement of matter deep among bones and tough fibrous structures. Therefore, if a depending part of the joint can be in any way reached, it should be widely incised; but the part *must* be depending. Pus must not be allowed to stagnate and putrefy in the recesses of the cavity, or pyæmia will be pretty certain. The difficulty of getting at the hip, except by a very deep cut, would render such means inapplicable to that joint. The trocar would be a better method of emptying the cavity; but the greatest caution must be used that no air be permitted to enter.

Case IX.—Henry Short, ætat. 31, came into Charing-Cross Hospital December 20th, 1859, having slipped down on the ice and hurt his knee. By the kindness of Mr. Hancock he is put under my care.

There is synovitis and much inflammatory fever; the swelling fills out the subcrural bursa very considerably, forces the patella away from the femur, and causes the popliteal space to be much less hollow. There is a tremulousness about this man, and an appearance generally which leads me to consider him a drunkard.

Bed; a straight splint with foot-board, duly padded, at the back of the limb. Bowels constipated: a purge of blue pill and black draught: cold lotion.

21st. Evidently the action has affected him: he is over tremulous; slept little last night.

Ordered to take the following pill night and morning:—

Cal. gr. ij; Opii gr. ss.

The drops every night:—

Træ. opii ♏xx.

Four ounces of gin.

24th. Better; but little pain in the knee; the tremulousness is gone: asked for more gin: refused. Let him go on.

28th. Blister above the joint to be dressed with simple ointment.

Jan. 3, 1860. The joint to be strapped.

10th. Discharged cured.

We have seen by Cases VII. and VIII. that wounds in joints are not always followed by synovitis; the next shows that traumatic synovitis need not always be suppurative.

Case X.—Charles Costrell, ætat. 22, strong and robust, shoemaker, ran an awl into his knee, 2d July, 1860; and on the 4th, feeling pain in the joint, came to Charing-Cross Hospital. Mr. Canton, under whose care he came, took the man in and kindly gave over the case to me.

There is considerable synovitis of the knee-joint; the shape of the swelling, the buoyancy of the patella, the heat of the part, and the inflammatory fever, sufficiently attest the fact. Ordered—Bed; wooden splint with a foot-board to the back of the limb; 8 leeches above the joint, a poultice afterwards. Five grains of blue pill to-night and an ounce and a half of compound senna mixture to-morrow morning.

6th. The fever continues; pulse hard, 92; he has not so much pain over the joint, but complains greatly of pain at the back of it; this, he says, was severe in the night and kept him awake. On examining the splint I found that the pads, which I had directed to be put under the popliteal region, had been neglected. I placed two thick pads, one longer than the other, under this part; the smaller one being in the middle, immediately behind the joint; this revealed the pain at once.

Ordered to take the following draught every six hours:—

℞. Vini antimon. potassio-tart. ♏xx.
Tr. opii ♏xij.
Aquæ ℥j.
M.

7th. He is less feverish and perspires freely; has very little pain in the joint, except at night on a point of the inner condyle, just internal to the patella, and this is sometimes very painful; there is much fluid in the knee-joint. Ordered a blister above the knee, in front, going across the whole lower and fore part of the thigh; to be dressed with simple ointment.

12th. The blister has nearly healed, though it rose well; the pain and amount of fluid both diminished; a blister to be applied below the knee-joint, that is to say, across the head of the tibia, to be treated in the same way.

16th. Better: the fluid has much diminished. Cold lotion.

21st. The limb was tighly strapped. Leave off the draught.

23d. The joint so much diminished that the strapping has to be renewed.

31st. He was allowed to walk with a crutch on the 26th, and two days afterwards a stick sufficed. He now begs to be discharged.

The three following are cases of suppurative synovitis:—

Case XI.—Margt. M., ætat. 9, fell down on the 9th July, 1858, on a hand basin, which she was carrying; broke it and cut her arm inside the elbow; she bled a good deal, and when this was stopped the wound was closed.

10th. Synovia was observed to escape, and on the

12th. A rigor set in; the elbow became very painful and swollen. Ordered tartrate of potash and senna draught, immediately; ten drops of laudanum at bedtime.

13th. The pain is most severe; there is much fluid in the joint, which can be felt through the thickened tissues; the opium has made her sleep. I laid the joint open, for a space of an inch and a half, along the inner edge of the olecranon and triceps tendon; much pus escaped.

To take the following, three times a day:—

℞. Quinæ sulph. gr. j.
Acidi acetici fort ♏x.
Liq. ammon. acet. ʒij.
Aquæ ℥j. M.

Continue the laudanum at night.

15th. She is less feverish; the wound discharges freely; the pus is healthy; she could eat some chicken to-day. She is to have meat whenever she can eat it, and a glass of port wine, daily: strong broths.

17th. Is better; appetite improves; pain much less; diminish the laudanum to seven drops.

20th. Allowed to get up for a few hours; discharge less; wound filling up.

This patient got well: when the wound in the joint had healed, before the external one had skinned over, I had friction used over the rest of the joint, and then passive motion at the end of the following month, August. In a fortnight after, there was still a little thickening, and she could not quite straighten the arm; in all other respects she was well.

Case XII.—Charles Hudson, ætat. 35, carpenter, came to me at the Charing-Cross Hospital on account of a wound over the knuckle of the left ring-finger, 22d June, 1860.

On the 13th of that month he had hurt his hand, jamming it between a plank and the wall, and at the same time a rusty nail wounded it over that knuckle. The wound became, as he said, very bad; and is now very painful, the pain running up the arm; there are no red lines, nor any enlargement of epicondyleian glands.

22d. There was a suppurating sore over the back of the metacarpo-phalangeal joint, with pale, flabby granulations. In its centre ran, directly down, a narrow sinus, into which, a probe being passed, came against no dead bone. When the phalanx was pressed against the metacarpal bone, without either flexing or straightening the joint in the least, pus flowed pretty freely from the sinus. There was evidently an opening into the joint, which was filled with matter. A free incision was made, laying the sinus and the joint open; a splint was placed in the front of the finger. The man was ordered to carry the hand in a sling, supinated, that the pus might flow out: to put a poultice upon the wound, and to take the following draught three times a day:—

℞. Spt. æth. chlor. ♏x.
Mist. quinæ ℥j. M.

25th. There has been a free discharge; pain less: wound looks healthier.

29th. Wound seems inclined to heal; no pus now escapes on pressing the joint surfaces together; the man is in no pain; the wound appears healing from the bottom, and soundly.

2d July. The wound is skinned over with a blue cicatrix; I am not quite confident of the soundness of the healing, as there appears to be fluid beneath the blue skin. Ordered to continue the medicine; to use passive motion.

10th. The cicatrix has got hard; the healing is quite sound, and the joint enjoys perfect freedom of motion, except that he cannot quite straighten the finger by the muscles of the part, although there is no obstruction when it is straightened by another hand.

Case XIII.—George Balster, ætat. 23, tailor, came among my out-patients to the Charing-Cross Hospital, 22d June, 1859.

A companion had, in fun, stabbed at him with a needle in the knee, on the 20th. He thought nothing of it, but the part is now painful.

The joint is slightly swelled, and he has a good deal of fever: he was recommended to come into the hospital, but would not; says he can be nursed at home, and will come in a cab: the little puncture may just be seen as a dark spot on the inside of the patella. Ordered 8 leeches; to be followed by hot poultice; splint: calomel and opium pills, 2 grains; and ½ grain night and morning.

24th. Came back: the limb is not better, rather worse; has much pain, and it is more swollen, more hot, and the skin is red: tried in vain to persuade him to come in: to continue the pills.

To take the following draught three times a day:—

℞. Potassæ nitratis gr. xv.
Spt. ætheris nitrici ♏xl.
Mist. camphoræ ℥j. M.

29th. His wife came to ask me to see him, as he is very ill: found him in great pain; the joint much more swollen, not merely from fluid in the cavity, but from œdema; the surface red and hot. It seems that on the 27th, about midnight, he had two or three shiverings, and could not be made to feel warm; he afterwards was restless and in great pain: last night wandered a good deal, and slept hardly at all. Tongue, brown; pulse, low and quick.

Ordered the following draught three times a day:—

℞. Ammoniæ carbonatis gr. v.
Træ. opii ♏xv.
Decocti cinchonæ ℥j. M.

A grain of opium, as a pill, at night; brandy, four ounces a day; the joint to be covered by a large poultice.

30th. Worse; hardly knew what was said to him; or, at least, could hardly answer; delirious, and talked, not loudly, a good deal in the night; even now, wanders a little. Made a long incision, down to the joint, on each side, and in front of hamstring tendons; about three ounces of pus, altogether, came away, with flocculi in it. To go on in the same way. One vessel was tied: lost very little blood.

2d July. He was a little better yesterday; the tongue was cleaner, and his manner less oppressed; he had a dose of castor oil: to-day he is evidently better; tongue cleaner; and he says he is easy: slept well last night without wandering. The wounds discharge freely.

5th. He may now be reckoned out of danger.

10th. Still goes on well; wounds granulating: substitute two pints of stout for brandy.

The end of this case was tedious. It soon became evident that the best that could be hoped for was a partially anchylosed joint. The treatment, at last, became limited to passive motion, rubbing, &c.; and he recovered, ultimately, with some very fair power of moving the limb.

CHAPTER III.

ACUTE RHEUMATISM.

PATHOLOGY.

ALTHOUGH acute rheumatism is a disease belonging to physicians I feel it necessary to enter somewhat minutely upon certain points connected with its pathology, because we shall then be able to trace therefrom the actions which take place in the chronic form of the disease, and because a very high authority has recorded his opinion that the local affection of the joints is not inflammatory.

The order in which the symptoms of rheumatic fever occur is not always the same, but whatever it be they are generally preceded by a certain feeling of *malaise* and vague wandering pains in the limbs, such as are usual before the actual invasion of any febrile disease. After a certain period of this incubation there comes on a shivering fit, accompanied or followed by great heat of skin and perspirations, and by the whole train of symptoms which constitute the perfect disease, a great part of which is pain and swelling in one or more joints. The affected joints are very painful, enlarged, hot, and red, and when first swollen fluctuate; but the most remarkable part of their condition is, that a joint thus suffering and exquisitely painful shall in a few hours lose these signs of inflammation, which are transferred to another and distant articulation.

A most important part also of the malady is the tendency exhibited by internal and vital organs to assume an inflammatory condition; thus, not only the peri- and endocardium, but the pleuræ, peritoneum, and the lungs themselves, become involved, moreover in the larger number of instances the inflammation proceeds rapidly to the deposition of lymph, producing thickening, adhesion, or consolidation, as the case may be.

Now, the whole clinical history of this disease clearly demonstrates it to be a specific fever produced by some poison in the blood, like typhus fever or the exanthemata, and, like these, rheumatism, besides producing the general symptoms which constitute it by their very nature a fever, also sets up actions on particular parts or textures of the body. The poison producing typhus, or any one of the eruptive fevers, is more complicated than is probably that which produces rheumatism; it is not to be defined by any chemical language or test, and is introduced into the body from without. On the contrary, the rheumatic poison is in all probability lactic acid, and owes its presence in so great excess either to a check on its excretion, or to its superabundant formation in the body, or to both;[1] and it may well be that one cause shall give rise to, or rather a train of circumstances shall act as a cause determining, both this excessive production and diminished excretion of lactic acid. Although external circumstances may and do produce rheumatism, the poison itself of the disease is elaborated in, and not out of, the body. Dr. Todd observes that "these causes must be admitted to be imperfect assimilation and vicissitudes of temperature, and hence the ill-clad and badly-fed children of the poor are the most frequent victims of rheumatism. Hard work, exposure to cold and wet, bad food, are strongly contrasted with the ease, comfort, and excess, which give rise to the analogous one of gout. If, now, we remember, that the skin is the great emunctory of lactic acid, and that bad or too little food may give rise to its undue development as well as too much food, it is no wonder that as lactic acid is imperfectly excreted through its natural channel in consequence of the influence of cold in checking perspirations, and is too freely developed in the alimentary canal, it should accumulate in the blood. Moreover the long continuance of the causes which produce the defective cutaneous secretion and the deranged gastric one, will give rise to the undue development of the lactic acid in the secondary destructive assimilative processess, thus infecting the blood from every source, and tending to perpetuate the diathesis."[2] When these processes take place quickly, the system becomes deluged with the acid, and rheumatic fever is the result, with its swelling of the joints, its peri- and endocarditis, its attacks on the pleura, peritoneum or membranes of the brain.

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[1] The experiments of Dr. Garrod, reported in the Med.-Chir. Trans., vol. xxxvi. 1854, are intended to prove that lithic acid is not the poison of rheumatism.

[2] Todd on Gout and Rheumatism, p. 143. London, 1843.

Now if we consider the structure of the parts which this disease particularly affects we shall see, first, that they are of the fibrous and serous or synovial structure, and examining yet more closely we find them to be composed of the white fibrous tissue.[1]

An attempt has been made by Dr. Todd, following the theories of Dr. Prout, to explain the action of the rheumatic diathesis on these tissues thus: "And it is not unimportant to remark, that all these tissues belong to the gelatinous and albuminous classes, and are chiefly composed of those proximate elements from the decomposition of which, in the wear and tear of the system, those great secondary organic compounds urea and lithic acid and lactic acid are produced. It is perfectly consistent with sound theory to suppose that these tissues are capable of exerting a special attraction on the gouty or rheumatic element, and this quite irrespectively of any anatomical explanation which might be offered."[2]

Dr. Fuller says: "It is worthy of note that the textures most commonly implicated in rheumatism are all examples of the albuminous and gelatinous tissues from the decomposition of which in the wear and tear of the body are formed those secondary organic compounds, the lithic and lactic acid, with which gout and rheumatism are intimately connected. And as it is but consistent with our knowledge respecting the processes of nutrition and assimilation to suppose that each tissue selects from the blood and appropriates to itself such matters as correspond to its chemical constitution, we may readily conceive that some peculiar attraction may be exerted by the fibrous and fibro-serous texture for compounds such as lithic and lactic acid, to which they bear so strong an affinity."[3]

These two quotations express a similar, or perhaps rather an identical theory—indeed it is difficult to avoid being impressed by a remarkable similarity in the verbiage even of the passages; and they have been thus placed in juxtaposition that certain objections to the theory may simultaneously apply to both authors. We will admit, without further question in this place, the theory of primary and secondary assimilation, with all its wide-spread ramifications; still it does not appear to me consistent either "with sound theory," or "with our knowledge," that a substance whose decomposition would produce a certain material should therefore attract that material. What theory of organic chemistry would teach that any substance has an affinity for a product of its own decomposition? Moreover, if tissues containing much gelatine should have, by virtue of that circumstance, a strong affinity for lactic acid, the skin would be especially affected, and we know that this organ is seldom attacked in rheumatism, and then only by a slight and generally a transient eruption. The acid perspiration is not to be looked upon as an affection of the skin, but simply as excretion by the integument of a morbid principle, lactic acid. Surely it is safer to accept fact simply as fact, until we can find a more correct explanation than one built on a false chemical assumption. Indeed, if it be necessary to explain chemically the relation between the affection of gelatinous tissues and the presence of lactic acid, the theory ought to run in the contrary direction: that the action in those parts was the cause of, and not the consequence of, the acid in the blood—since the decomposition of those tissues will produce that acid they therefore have no chemical affinity for it.

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[1] Cartilage periosteum are only modifications of this tissue.

[2] Todd on Gout and Rheumatism, p. 141. London, 1843.

[3] Fuller on Rheumatism, Gout, and Sciatica, p. 49. London, 1856.

The condition of parts attacked in rheumatic fever is, as I hope clearly to show, inflammation; on the state of the membranes of the heart or other internal tissues affected, there is no doubt; but some disbelief has been thrown upon the inflammatory nature of the joint affection, and as that subject chiefly concerns us, it is right to go over carefully the reasons for or against such opinions. The reasons against the inflammatory nature of the joint affection in rheumatic fever are summed up by Dr. Todd in that part of his Croonian Lectures which is devoted to proving that "rheumatic fever is not symptomatic of local disorder;"[1] and if that eminent physician had confined himself simply to proving this point, no word could with justice have been raised against his conclusions; but in doing this he has also endeavored to show the non-inflammatory condition of the joint affection, and in that he has, I think, failed. In order to treat such an authority with all the respect that his opinions merit, it is necessary to quote his reasons in full, even at the risk of appearing tedious, so that none of his arguments may lose their due weight and significance, and that the criticisms which I shall have to offer may be duly contrasted with his propositions.

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[1] Gout and Rheumatism, p. 134 et seq.

"And now let me say a few words in reference to the hypothesis, which some have advocated, that the rheumatic fever is merely symptomatic of a local inflammation, affecting one or more joints. Such an hypothesis is very far from affording a satisfactory explanation of the phenomena.

"1. It will not explain the peculiar diathesis, nor the limitation to a peculiar period of life. In the diathesis the constitutional disturbance is often, beyond all proportion, greater than the local affection; so that, in some instances, the latter is overlooked, or attributed to a wrong cause, in the anxiety which is excited by the altered appearance, imperfect nutrition of the patient; or until some vital part is touched, as the heart, the functions of which become impaired. And, in the paroxysm of rheumatic fever, the constitutional disturbance is far greater than can be accounted for by the local mischief, and, as Dr. Graves has shown, may exist without any affection of the joints at all.

"2. It will not account for the affection of the heart. It is true that we meet with instances where a local malady will give rise to affection of some distant part; but, when this is the case, the secondary affection is similar to the primary one. Thus cancer at one part will produce cancer in another. But in rheumatism, on this hypothesis, we should find an affection of the heart, which essentially consists in the effusion of coagulable lymph, produced by an articular affection showing no such sign.

"3. I repeat that we have no satisfactory evidence that the articular affections are truly of the nature of ordinary inflammation. The parts are certainly swollen, painful, and there is a considerable flow of blood to them; but they do not suffer, even from the effusion of coagulable lymph; much less are they the subject of those destructive and disorganizing processes, which so often follow in the wake of a true inflammation. Nor is it the nature of a true inflammation to desert, quickly, one part, leaving it unimpaired, and to fasten upon another; and, after making a short sojourn there, to revisit its old abode, or to fly to some new region. It is true that, in some instances, the joints do not escape unharmed; but a slow derangement of their nutrition is induced—which may go on for years and years—which alters the textures, and even allows them to wear away; and which resists those remedies that usually check an inflammatory process. This, although often called inflammation of chronic kind, is surely more like the slow and insidious working of a canker, which dries up or impairs the matter destined for the nourishment of the tissues.

"I do not, however, wish to be understood as denying that the ordinary effects of inflammation do take place in rheumatic joints. I am bound to admit that some cases are on record which seem to partake of this nature; but such instances are extremely rare; and their occurrence does not invalidate my argument; on the contrary, here *exceptio probat regulam.* In these cases the poison has been more strongly attracted to a particular joint or joints, and others have consequently suffered less; and the remarkable disposition which rheumatism has to shift from joint to joint is absent.

"4. Let us compare with the rheumatic paroxysm the constitutional disturbance, which an undoubted inflammation of ordinary kind, affecting a joint, creates, when not connected with a constitutional taint.

"In the latter case, the fever is always directly proportioned to the local disturbance. The pain of the joint, and the difficulty of using it, are the first and chief objects of the patient's attention; and it is not until the destructive inflammation has proceeded to a great length, that his constitution begins to suffer, and the febrile disturbance begins to wear him out. The amputating-knife, by removing the source of the irritation, speedily puts a stop to the fever; and it often happens, that the night after an operation of this kind proves the first one of rest and refreshing sleep which the patient has enjoyed for many weeks. How different is this description from that of the irritative fever of the rheumatic paroxysm! Were a rheumatic limb to be amputated, how different would be the surgeon's account of his patient!

"5. But it may be said, you cannot deny that inflammation of the heart exists, for there you have the products of inflammation in abundance. May we not infer that, because the heart is inflamed the joints must be so likewise, and that lymph is effused in them also, which subsequently becomes absorbed? To this I reply, that the heart is very differently circumstanced from the joints; these are rendered absolutely incapable of motion, whilst that is moving with even more vigor and rapidity than usual, contracting with energy, and occasioning a considerable amount of friction between the opposed surfaces of its serous membrane. Surely these are conditions more likely to excite inflammation, especially if an irritant fluid be in contact, than the absolute rest, to which the joints are of necessity condemned. Doubtless, if the joints could be freely used during the paroxysm, they would more frequently exhibit marks of destructive inflammation as a consequence of the rheumatic paroxysm.[1] Moreover, the heart may be said to be bathed in blood; for not only are its cavities filled with the fluid, but its exterior is surrounded by moisture derived from the serum; which, doubtless, contains the essence of any morbid element the latter may hold in solution; and, besides all this, the very substance of the heart is permeated by bloodvessels, which ramify to a degree of minuteness of which no one can form an adequate conception, who has not had the opportunity of examining a minutely injected specimen with the aid of the microscope.

"Lastly, it has been said that this is an inflammation of the fibrous system, and the weight and authority of the great name of Bichat have tended greatly to propagate this error. But so little satisfactory is this theory, that some practical physicians have endeavored to make a distinction between what they call synovial or bursal rheumatism, and fibrous rheumatism. The natural history of the disease, however, does not warrant this distinction, for in no instance of rheumatic fever are the membranes free from irritation, as evinced by the existence of effusions, and the synovial membranes can scarcely be affected without involving the fibrous tissues which surround, support, and connect the bloodvessels to them."

I. On the paragraph numbered I. there is little to observe, for I do not intend to show that rheumatic fever is simply symptomatic of joint inflammation, but that to a diathetic fever an inflammation of the joints is superadded. If under ordinary circumstances, *i. e.*, if while the constitution were in no way affected, we could produce such a joint attack, it would be accompanied with symptomatic fever; but any such action is in acute rheumatism completely masked; yet none can deny that the intense pain and tenderness of the joints may add considerably to the irritability of the patient.

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[1] "See Dr. Corrigan's paper in the Dublin Journal, vol. xvi."—Note by Dr. Todd.

II. It is quite certain that the joint affection does not produce the heart affection; they are both brought about by the same causes, viz., the constitutional state, and therefore it is right to suppose that the same diathetic condition would produce the same local derangement: it is inflammation in the heart—why must it be another condition of the joints? It is questionable whether they are so dissimilar as Dr. Todd supposes, as will be seen in Proposition V.; and in making use of the disease cancer to demonstrate that if a local affection produce a distant one, both diseases are similar, Dr. Todd has chosen (I presume accidentally) a remarkably illustrative example. Primary cancer, although it be scirrhus, is nearly always followed by encephaloid: the two diseases are essentially the same, but their morbid anatomy slightly different.

III. Concerning the presence of coagulable lymph, I must refer the reader to No. V., but I may here say that there usually is in the joints some inflammatory exudation. "That it is not the nature of true inflammation to desert quickly one part and fasten upon another," is a phrase with an amount of ambiguity about it, owing to a want of definition of the word "true." If erysipelas be a true inflammation, then metastasis is the nature of some such affections. There have been recorded several cases of orchitis with sudden metastasis to the parotid or to the brain. The refusal of the joint malady to yield to the ordinary remedies of inflammation does not prove that it is not inflammation, but simply that there is something which acts as a constant irritant, viz., the diathesis. We should not expect to cure a conjunctivitis as long as there were a piece of quicklime under the eyelid. The slow derangement of nutrition to which Dr. Todd refers is not merely wear of the joint surfaces; there is actual absorption in some parts, and deposition of new matter in others. Hence it is to my mind more like a true chronic inflammation than to any other morbid process or to any "canker."

IV. Dr. Todd's fourth paragraph refers only to the idiopathic nature of the fever.

V. The stress which Dr. Todd lays upon the different circumstances, as to the necessity or non-necessity of motion in which the heart and joints are placed, would lead one to infer that these could make the difference between the possibility of the organs to become inflamed. Very little consideration, however, will show that such is not the case. In a normal condition both the heart and the joints move readily without pain or inconvenience; but there suddenly arises a morbid state of the system which renders first the movement of certain joints so painful that the patient, except on urgent necessity, keeps them still; and then the motions of the heart also become painful, but must go on unless the patient is to die; but in neither case is the morbid state produced by movement; the joints, indeed, which move less than, are generally affected before the heart. The constant movement of the heart, then, can only aggravate the condition, not produce it. If then, in its aggravated state, as in the heart, it is inflammation, what else is the unaggravated disease of the joints? what is it that produces the swelling and effusion, the heat, &c.? In regard to the heart being bathed in blood internally and externally, the actual presence of blood in the cavity is the only difference between it and the joints; and even here the blood is intravascular, the fluid of the pericardium being quite comparable to the synovial.

The above quotation from Dr. Todd's admirable lectures, and such answers as I have been able to give to his conclusions, appeared to me desirable from the great weight which any opinion of such an authority must carry with it; yet the question is not to be decided by logic, but by morbid anatomy.

The superabundant synovia secreted into the joints during acute rheumatism is quite at first of entirely normal consistence and color, but in a number of days, which varies, and the limits of whose fluctuation I am as yet unable to define, this fluid changes color, and becomes first of a greenish hue, then slightly opalescent flocculi appear in it, and then, in the most advanced stage, it becomes more nearly opaque and whitish. At this time the synovial membrane is reddened, either in broad patches or isolated spots, and several arborescent vessels appear; soon after, the inner surface of the membrane becomes granular, and shreds of soft gelatinous false membrane are seen adhering to it, and it gradually becomes thicker. In the mean time the fibrous textures around the joint at first lose more and more their lustre and pearly appearance, and soon after become bathed in a yellowish effusion which has an acid reaction.

CASE XIV. Dennis Loughlin died in the Charing-Cross Hospital during multilocular rheumatism, and the body was examined.

There was both peri and endocarditis. The pericardium contained much fluid, and was studded with false membranes and shreds of lymph.

I examined the left knee and ankle; the latter had only been lately affected.

Knee.—The periarticular tissues contain a good deal of effused yellow serum. The subsynovial tissue is swollen and thickened; the synovial membrane is itself thickened; its inner surface is redder than normal, and some long branching vessels are to be seen running across it. In two places, one at the outside of the patella, the other at the inner side above the interarticular cartilages, are false membranes; the former nearly as big as a shilling, but oval; the latter smaller, which adhere pretty closely to the membrane. The fluid in the joint is large in quantity, probably between three and four ounces; it is turbid, opalescent, and four shreds are floating in it; one of these, the largest, is a white flocculus, half an inch long: two of them are quite transparent and gelatiform; a gelatinous concretion rests on the inner condyle of the femur; it was not originally adherent, but merely agglutinated. When this jelly was removed the cartilage beneath it was quite normal, as also were the cartilages throughout.

Ankle.—The sheaths of the tendons, particularly those in front of the joint, contained a good deal of yellow, straw-colored, thready fluid. The periarticular tissues contained also fluid; the synovial membrane slightly thickened, its inner surface red; arborescent vessels very visible, at the back were two small spots of extravasation beneath the basement membrane. No adherent false membranes. A good deal of yellowish-green transparent fluid in the joint; two small gelatinous shreds were floating in it.

Case XV.—From a paper by J. Cossey in the *Archives Générales* for March, 1854.

J. Cossey describes at length two cases of acute rheumatism, with cerebral affection, of which the patients died. At the post mortem the joints were examined and described as follows:—

Articulations.—All those which have been the seat of rheumatic affection were examined with care. Externally, these joints showed no external discoloration, and scarcely any swelling.

Left Shoulder.—Synovia limpid, yellowish, and *filante* in tolerable abundance; articular surfaces and synovial membrane perfectly normal.

Elbows.—The right was healthy, but the left has suffered. Synovia more abundant than in the right, of a greenish-yellow, opalescent, and contains some albuminous shreds; nevertheless, it remains ropy (*est toujours bien filante*). Synovial membrane markedly injected, particularly at its sub-olecranon pouch; there is no perceptible thickening; cartilages heathy.

Wrists.—The cartilages and synovial membranes of both joints were healthy. Synovia *filante* opalescent, rather deficient in the left, but still the joint was not dry. The tendinous sheaths, and the cellular tissue around the joint, in the normal condition.

Knees.—The right contained two large tablespoonfuls of synovia, which was ropy, transparent, yellow verging into green, and in which floated freely some albuminous shreds. Synovial membrane somewhat injected throughout, but more particularly in its subcrural pouch, and on the folds which this membrane forms at the side of the ligamentum patellæ. It presented no evident thickening. Cartilages healthy.

Left knee, a tablespoonful of transparent, threading synovia, without any yellow-green lustre, and containing but one albuminous shred, small, transparent, and gelatinous in consistence. The synovial membrane contrasted by its pallor with that of the opposite side. Cartilages healthy.

In the two ankles the synovial membrane and cartilages were healthy; the synovia normal, both in quantity and quality. One of the articulations contained a little transparent, gelatinous shred.

The fibrous tissues around the joints above described were healthy, and in some others they only presented rather more moisture than they do in health, but there was no trace of pus.

Case XVI., from J. Cossey.

Shoulders.—The right is healthy, in the left is a tablespoonful of ropy synovia, which is opalescent, slightly green, and contains shreds. The synovial membrane is not perceptibly injected, but comparison with that of the other side shows it to be slightly thickened; cartilages healthy; elbows healthy in every way; wrists a little puffy externally, but less so than during life. The left one contains a little ropy synovia, opalescent, and of a greenish-yellow color. The membrane itself is, on its free surface, slightly granular, and has on it a few irregularly disposed red patches. The articular surfaces perfectly healthy. The subcutaneous cellular tissue around the joint is infiltrated with limpid lemon-colored serum without a trace of pus. The right wrist is healthy; the surrounding cellular tissue is, like that on the left side, slightly infiltrated, and the synovia in the extensor sheaths is opalescent without other alteration. Hips healthy. Knees still a little swollen, the right more so than the left. In the right was a rather large quantity of synovia, which was ropy, greenish-yellow, turbid, and contained shreds. The *synovial membrane,* where it lined the tendon of the rectus femoris, was pale and smooth, but at the sides of the patella, about the cruciform ligament, and in the subcrural pouch (cul-de-sac sus-rotulien) its surface is finely granulated, and of an irregular red hue. The subsynovial tissues are not perceptibly altered in any way; and the membrane itself, at those parts where it is granular, is thickened, but so slightly that the thickening is only perceptible when compared with a similar membrane taken from a healthy subject. In the left knee, except that it contains rather less synovia, there are just the same appearances as in the right. Ankles quite healthy, both as regards the synovia, membrane, and cartilages; there were no abscesses nor any purulent or sanguineous infiltrations.

It is to be observed in both these cases that the first died on the eighteenth day of the disease, the second on the ninth; that the joints, in which was most pain, and which had been longest attacked, were found most injured.

Case XVII., from A. Bonnet, of Lyons,[1] furnished him by M. Rodel. The patient was a woman, aged 52, of a good constitution. She was admitted into the Hôtel-Dieu on the 3d of August, eight days after having been attacked with rheumatism in consequence of a chill, and she died on the 20th of August, on the twenty-fifth day of the disease. The pains of acute rheumatism had invaded successively nearly all the joints of the upper and lower limbs. Several of them had become red and swollen. Death seemed owing to cerebral symptoms, which made their appearance five days before death. The patient was attacked with violent delirium, accompanied by very severe pains in the head, exchanged during the last two days for profound coma. The patient had been treated by somewhat slight measures—two bleedings, leeches, small doses of camphor and nitre, blisters on the joints, &c.

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[1] Maladies des Articulations, p. 329.

The autopsy was made forty hours after death, when decomposition was far advanced.

Both knees contained three or four tablespoonfuls of a transparent serosity, all the membrane was red, œdematous, and studded with little fringes that were much injected. Its vessels were prolonged over the circumference of the cartilage, which was ulcerated and grooved in several spots of the articulating surfaces of the tibia, femur, and patella. Several spots of the cartilage, more particularly of this latter bone, were velvety, and transformed into fibres six or seven millimètres long, and more or less isolated from one another. It appeared as though the juxtaposed fibres, whereof cartilage is composed, had been separated one from the other, and that they were slightly hypertrophied.

The same alterations were present in the left elbow. The lesion of the cartilage was farthest advanced upon the articular surface of the ulna.

There was no alteration of cartilages in the two tibio-tarsal, in the first tarsal, in either hip, nor in the right wrist-joint—the synovial membrane merely was injected and contained some serous effusion.

The shoulder-joints and right wrist (*sic*) had undergone no change. There was no alteration in the fibrous structure of any joint.

The heart, the lungs, and the brain were examined, but no change was found which might not be attributed to decomposition.

CASE XVIII.—Acute Rheumatism.—This account is kindly furnished me by my friend Dr. Bristowe.

William Hills, 49, engineer, admitted into St. Thomas's Hospital, Luke's Ward, under care of Dr. Barker, September 15, 1859.

The man had had acute rheumatism for eight days before admission, without much joint affection. The heart was daily examined without the detection of any abnormal sound. The patient was noticed to be very sulky and short in his answers. On the 23d of September, when convalescent and walking about the ward, he fell down dead without having exhibited any signs of distress whatever. He was treated with large doses of nitrate of potash.

Post-mortem by Dr. Bristowe, September 24th, 1859.

Head.—Brain and its membranes healthy.

Chest.—Larynx and trachea healthy. There were numerous fibrinous adhesions throughout both pleuræ. The lungs were of the usual size, crepitant throughout, but congested. The apices were punctured, and there was considerable emphysema at the apices along the anterior edges, and at the bases of the organs. Bronchial tubes healthy. The pericardium was adherent throughout the greater part of its extent by a layer of somewhat recently effused lymph. The adhesions were not complete on the right side, and the cavity left contained about an ounce of slightly turbid serum. The heart was large. The walls of the left ventricle were thick, firm, and healthy-looking; they were contracted, and the cavity was empty. The valves were healthy. The walls of the right ventricle were considerably thicker than natural, the cavity was dilated and filled with coagulum. The coagulum was partly fibrinous, and partly black-currant-jelly-like. The latter was in contact with the walls of the ventricle, and was prolonged up the cornus arteriosus along the pulmonary artery and its first branches, was moulded to the organs, and was so thick that it appeared actually to fill them. On opening this clot a mass of fibrinous coagulum, about as large as a walnut, was found in its interior, from which several cylindrical processes were prolonged in various directions. The largest, about as thick as the little finger, occupied the axis of the clot in the cornus arteriosus and commencement of the pulmonary artery, but the others were smaller, about the size of goosequills, were convoluted and twisted in various directions, and did not, so far as could be seen, correspond to any vessel, although they looked as if they had been moulded therein. The fibrinous masses were yellowish, close-grained, tough, and uniform throughout, easily separable, and apparently distinct from the colored clots surrounding them. The right auricle was distended like the ventricle by coagulum, the outer part of which was dull and soft, the inner fibrinous, and presenting curling cylindrical cast-like fibrinations, which, although they looked as if they had been formed in vessels, were contained wholly in the colored clot, and did not extend into any of the veins. Valves on right side healthy. *Abdomen*-peritoneum healthy; liver, spleen, pancreas, stomach and intestines healthy. One of the kidneys was about half as long again as usual, about one-third of it being partially separated from the remainder by a deep fissure; kidneys otherwise healthy. Aorta healthy.

Knee.—The patient had been suffering from rheumatism, and the left knee-joint was laid open in order to ascertain its condition; a few drachms of a thin straw-colored fluid oozed away. There was fibrous degeneration of the cartilages of the inner side of the patella, the surface of the synovial membrane was somewhat redder than usual, especially along the margins of the cartilages, and it presented a slightly granular appearance in many parts. There did not appear to be any disease of the surrounding tissues. The fibrous part of the cartilage presented the usual character of that form of degeneration. The synovial membrane presented under the microscope a large number of tortuous congested vessels, and the surface itself was studded with papillæ and small pedunculated processes, consisting apparently chiefly of nucleated cells. They were the processes recently observed upon the surface of these membranes.

P.S.—The muscular tissue of the heart was examined under the microscope, and appeared healthy; and this was the case with that portion even which was in immediate contact with the inflamed pericardium.

These cases suffice not only to prove that the disease in the joints is inflammation; but also to illustrate its morbid anatomy, viz., inflammation of, and effusion into, the synovial membrane, and the periarticular tissues, followed by thickening of those parts. In severe cases the effusion becomes opalescent, even puriform, and the cartilages partake in the inflammatory action. The metastatic quality of this inflammation is very remarkable, but the description given of the sudden disappearance of all morbid symptoms is usually exaggerated; for although there can be no doubt that the inflammation itself changes places with extreme rapidity, it is not true that the part lately affected is left in a perfectly healthy condition; on the contrary, considerable swelling still remains, and disappears more or less slowly according to the greater or less amount of effusion and thickening. On the symptoms of this disease I shall not enter, as it belongs to the physician; but it is well to observe that the surface of the joints are redder than in any other form of arthritis, showing that the areolar tissue is more widely involved, so that even the subcutaneous layers are inflamed and the effects do not always disappear with the fever; but sometimes a joint, generally a large one, as the knee or the elbow, is altered and requires considerable attention and care; sometimes, even in spite of all that art can do, the limb can never be recovered.

The following is a case in which, after rheumatic fever, an affected joint did not recover. It serves to show a close connection between gout and rheumatism, or at least, possibility of the one changing to the other.

Case XIX.—Miss B., ætat. 19, daughter of a medical practitioner residing a little way from town, stout and healthy-looking, had rheumatic fever fourteen years ago, from which she recovered without further lesion than lameness and enlargement of the right knee-joint: this affection, instead of getting better slowly, became worse. During the whole of the summer of 1857 she suffered much pain, and there was very distinct and audible crepitus between the femur and tibia, which latter bone was very loose, and could be twisted partially round; the patella was fixed—all movement and pressure painful. Every means was resorted to in order to save pain and reduce swelling; but everything failed, and at last it was determined, in a consultation between Mr. Hancock and Mr. Henry George Johnson, that it was better to remove the limb.

On the 9th November, 1857, therefore, I accompanied Mr. Hancock to ———, where, assisted also by Mr. Hird and Mr. H. G. Johnson, Mr. Hancock removed the limb above the knee. I took the part home and examined it the same evening.

There was a good deal of healthy fat around the joint. When the fibrous tissues around the sheaths of tendons and the ligaments were reached, they were found infiltrated or occupied by a soft cretaceous matter, in great abundance; in some places, as about and in the internal lateral ligament, the accumulation of this material was so considerable that the ligament seemed stretched out and to cover it in like a cyst.

On opening the joint a quantity of thin milk-like fluid, containing a gritty matter in suspension, flowed away. The whole cavity was filled with a similar chalky matter to that above described, and which, when placed under the microscope, was seen to contain crystals of urate of soda. Every structure of the joint itself, except a sac like a thin fascia, and which was probably thickened synovial membrane, had disappeared; cartilages, crucial ligaments, and joint surfaces of bone, were all absent. The new bone surfaces were very irregular, having uneven rounded eminences and depressions that fitted rudely into one another; the patella was firmly anchylosed high up on the femur.[1]

This case shows a singular connection between rheumatism and gout, and should certainly be of much pathological interest in aiding to clear up some of the very difficult questions connected with the subject; but such a termination to a rheumatic attack is, I conceive, extremely rare. The more usual alteration to be found in joints, as a result of the chronic inflammation left behind by rheumatic fever, is thickening of the fibrous structures, such as will be described in a future chapter.

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[1] I put this joint into spirit, and it is still in my possession; I have been kindly allowed by Mr. Hancock to preserve it.

CHAPTER IV.

PYARTHROSIS.

It is a remarkable fact that any one disease should, like the one now under consideration, produce in one form such a typhoid condition as to be almost invariably fatal, and in another should cause as its prominent symptom merely swelling and inflammation of the joints so like subacute rheumatism as very frequently to be mistaken for that disease. Indeed one form of so-called rheumatism (the gonorrhœal) is but a mild form of purulent infection, and certain other cases happening in puerperal women belong to the same category.

The course of the severer form of the attack may be thus stated in the briefest manner. During a suppuration in some part of the body, there supervenes a low form of fever, generally preceded by shiverings, and accompanied by great nervous depression; the discharge changes in character, or may stop altogether; abscesses are developed in various parts of the body, in joints, among the deep muscles, in the lung, liver, &c. After death, veins leading from the seat of suppuration will generally, some affirm always, be found inflamed, sometimes containing pus, and broken-down coagula.

The milder form of the malady takes a different course. During the healing of a small wound, during a purulent discharge from a mucous membrane, and sometimes, though rarely, while no source of suppuration can be discovered, the patient will be attacked by shiverings followed by pain in a joint, subsequently perhaps in several joints; soon swelling of these parts comes on, and the pain is generally very severe. The powers of the patient are depressed, and the tongue is brown and dry; but the symptoms are scarcely typhoid. The swelling may wander from one joint to another, although there is great preference for the knee; sometimes, though not constantly, when the attack goes to another articulation, it leaves the one first affected quite free; subsequently the patient may get perfectly well; but generally one or more of the affected joints is permanently injured, and the patient will probably believe that he has had a rheumatic attack.

It is only when a large number of cases have been seen, and when connecting links between the first form of this disease and the second have been supplied, that our view of the whole malady becomes broad enough to allow our perceiving the relationship between its different manifestations. Its pathology is, however, extremely obscure, as may be gathered from the number of names applied to the malady, each name having some tendency to denote a certain theory of production. Purulent absorption, purulent infection, pyæmia, ichorhæmia, septicæmia, are a few only of its designations.

The first of these names, purulent absorption, is an exponent of one mode of accounting for the origin of the disease; namely, by the simple bodily absorption of pus into the circulation, whose corpuscles, it is affirmed, may be seen in the blood (Sedillot, *De l'Infection Purulente*), and which are supposed to produce mechanical closure of some small vessel or vessels, as happens with insoluble powders injected into the veins. These pus-corpuscles are imagined as being subsequently deposited in the tissues, thus forming abscesses. Another theory of the ill effects, said to be produced by pus in the blood, is that it causes that fluid to coagulate, and thus renders it unfit for circulation.[1]

Now, in the first place, pus cannot be absorbed by a vein whose coats are intact, and if an opening be made and remain in such a vessel, or if it be cut through as in amputations, it never remains pervious from the opening or cut end upwards, but is closed by coagulum which would prevent the simple and bodily flow of pus from a suppurating wound into the blood.

Then the blood normally contains certain white cells which cannot be distinguished from pus-cells, and though there are in this disease more white corpuscles than usual, the same happens in very many maladies, and I believe in every depressed state of system; hence the mere presence of an increased number of such bodies could by no means warrant the conclusion that some of them were pus-cells. As these normal white cells are in size and form exactly like pus-cells, no vessel that would allow one set to pass could be obstructed by the other. Thirdly, the formation of the secondary abscesses is not merely a passive infiltration of the tissues with pus; but is always preceded by the development of foci of inflammation, some of which do not suppurate, and those which do form their pus from the tissue, as in every other case; even if a pus-corpuscle could get into the blood through any artificial opening in a vessel, it could only get out again through the same or another artificial opening, or by making an opening for itself. Lastly and chiefly, pure pus, if proper precautions in its introduction be observed, produces neither coagulation of the blood, nor any symptom of purulent infection. Mr. Henry Lee, whose experiments upon this subject are so well known, must have been unfortunately betrayed into an error by the method used in injecting the pus. Virchow has shown[1] that most of Sedillot's experiments were vitiated by the mode in which the wound was made, and the nozzle of the injecting-tube thrust in; for blood must have formed coagula around these parts, which afterwards were carried into the circulation. Mr. H. Lee's experiments being performed on a similar method, are clearly as open to the same sources of fallacy. In the vast majority of instances, when sufficient care has been taken in the method of injection, and in the selection of a pure pus, no symptoms have followed the operation. A commission repeating these experiments, twice found negative results in both instances. Beck found in fourteen injections that not one was followed by symptoms of purulent infection.

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[1] **Henry Lee, F. R. S., On Phlebitis.**

In the "Prize Essay on Inflammation of the Veins," by Mr. Henry Lee, just referred to, that surgeon gives an account of three experiments performed on asses of different ages, by the injection of pure pus into a vein.

In each case the vein thus treated became immediately hard and corded, in one so violently, that "*even forcible pressure was not sufficient to overcome the resistance offered to the return of blood.*" Every one of the animals was visibly affected within 2½ hours: the first died on the third day; the second, on the fourth day; and the last was, on the second day, in great danger of death, but recovered, so that he was killed on the tenth day after the operation. In all the animals were found, after death, more or less phlebitis and abscesses.

Shortly after the appearance of this excellent essay, a committee was appointed by the Edinburgh Physiological Society to repeat these experiments. They furnished their Report on the 8th January, 1853; it may be seen at length in the *Edinburgh Monthly Journal*, vol. vii. p. 272.

Report of a committee appointed to repeat Mr. H. Lee's experiments on an ass, with a view of determining local effects of pus on the blood:—

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[1] "Ueber Embolie und Infektion Gesammelte Abhandlungen," p. 643.

"EXPERIMENT I.—The saphena vein of an ass was exposed, and a tube introduced, confined by a ligature. Fresh and healthy pus was then slowly injected, *upwards*, towards the heart, from a syringe holding an ounce. A slight obstruction was now perceived, and the vein above the ligature could be seen to be somewhat swollen. This swelling, on being felt, was very soft; and, on pressing the vein from below upwards, the mixed blood and pus was readily pushed before the finger; when all obstruction to the passage of pus from the syringe was removed, the syringe was again filled, and another ounce of pus injected without occasioning any further local effects. The animal was then allowed to get up, and exhibited no change in its normal condition.

"EXPERIMENT II.—The same ass was the subject of another experiment, having been perfectly well in the interval. Six inches of the jugular vein, in the neck, were carefully dissected and exposed, and a minute aperture was then made in the upper end of the exposed vein, and the bent tube of a syringe introduced without a ligature. The coats of the vein were so transparent that the flowing blood could be seen through them; an ounce of fresh and perfectly healthy pus was then slowly injected *downwards* towards the heart, and owing to the transparency of the vein, the yellow opaque fluid could be seen to join the blood, to continue a few moments running side by side with the crimson current, until, at length, the vein became full of pus. On removing the syringe to obtain a fresh supply, the blood from above could be seen to join the pus, to continue side by side with that fluid, presenting a streaked red and white appearance, without any coagulation, until all the pus was carried forward and downward towards the heart, and the vein became again full of blood. Another syringe full of pus was then injected, which could once more be seen to flow with the blood, then, as its quantity increased, to take the place of the blood; and then, on the syringe being exhausted, to receive blood from above, the two mixing together and continuing their course, without coagulating, until once more the vein contained nothing but blood; the wound was now closed, and the animal allowed to rise, which he did without apparent suffering. He presented no unusual symptoms during the next few days, when he was killed, and the parts carefully dissected. The vein was pervious, presenting no thickening, nor cording, nor abscesses, and the external wound was nearly healed."

Thus the evidence is altogether against the idea that pus can in its totality be absorbed, and that even if this could take place that it would produce the disease under consideration. Hence the name purulent absorption, inasmuch as it tends to fix upon the disease the simple absorption of pus as its cause, is inadmissible, and pyæmia is equally objectionable. Purulent infection appears to me more admissible, since it denotes that the system is vitiated by an infecting pus without defining the mode of infection, nor the condition of the purulent fluid.

Ichorhæmia and septicæmia occupy at once a different ground, and assert, the first, that the blood contains unhealthy, putrid pus or ichor; the other, that the blood is rendered putrid by the influence of decaying matter. Experiments have of course been tried for the sake of proving the first position by injecting putrid pus into the veins, precautions having been used to prevent solid portions being injected with it. The results of such experiments are extremely unsatisfactory, and do not go far to prove anything, except the intense difficulty of all such research. The mode chosen for experiment, namely, injecting putrid pus into a vein, does not imitate nature sufficiently closely to render the results very reliable, for such pus cannot be absorbed *en masse* in nature, and the rapid introduction of putrid material into the body is a very different thing from the gradual vitiation of the system by the same material; and then again the same source of fallacy by coagulation of the blood is still more apt to occur. As to results we have only the production of secondary abscess in a percental higher ratio, than when pure pus is used; but there is in those instances the remarkable fact that such abscesses have always the same smell and qualities as the pus injected. In by far the larger number of cases, about seventy-five per cent., the symptoms produced are those of a typhoid fever with diarrhœa, the stools being horribly fetid, and the intestines are afterwards found to be ulcerated.

Now, as we see that the injection of putrid pus into the blood is much more apt to coagulate portions of that fluid than if pure pus be used, it may well be doubted whether the percental difference in the formation of secondary abscess be not altogether owing to that cause. The fact, that the secondary abscesses, when they form, smell like the injected fluid, does not prove that the pus of the abscess is a portion of that injected; since it would certainly happen, that the sulphuretted hydrogen, or other ill-odorous material which gave the putrid character to the pus, would impart a similar, but diluted evil savor to the whole circulating fluid, and would come out in the secretions, hence the intestinal evacuations have the same odor. The injection of a quantity of such pus, producing so often a different set of symptoms, and particularly diarrhœa, shows that the mode of experimentation is inapplicable, the poison finding its own emunctory acts as its own antidote—just as an ignorant monomaniac will take such a dose of oxalic acid that the stomach rejects it, and the poison cannot take due effect. The experiments, though they prove nothing whatever, would lead us to consider it probable that the putrescence of the material is the cause of the evil; but whether by direct absorption into the blood, or by an indirect action on that fluid, is very doubtful. Dr. Julius Vogel (Virchow's *Handbuch der Pathologie und Therapie*) leans very strongly to this latter opinion, and to him the name septicæmia is due. He affirms that the blood in this disease may be variously affected by the development therein of lactic and hydrosulphuric acid, of carbonate of ammonia, of abnormal quantities, and several morbid forms of extractive matter, &c. &c. These statements require, however, further confirmation; but in support of the septicæmic theory, it must be acknowledged that the blood has a power of multiplying any organic morbid poison introduced into it from without (hence I believe the term zymosis); and whether the blood be poisoned by the absorption of the fetid gas, or of the putrid pus, it seems probable that this poison is multiplied in the blood, as is the case with the pus of smallpox, or of glanders, when inoculated.

All the experiments hitherto performed, however, throw only a negative and doubtful light upon this subject; and their sources of fallacy are still further increased, if it be considered that in many instances a phlebitis is found to stand in some relationship of cause to the disease. Such a relationship allows us to doubt whether, even in the instances when secondary abscess followed the injection of pus, the phenomena may not have been caused by irritation and inflammation of the vein, and not by the mixture of the pus injected with the blood. In such a mode of accounting for the phenomena, the injecting pipe would be regarded as the irritating body, and the influence of pure pus, local and general, must be considered null. The greater frequency of secondary abscess, when foul pus is injected, may well be attributed to its local irritant action. One consequence of the phlebitis is suppuration of the inner coat of the vein; another is the formation of a clot, which subsequently suppurates, softens, and perhaps putrefies; hence the admixture of pus, of putrid matters, and of portions of solid coagula with the blood. From this fact Virchow argues plausibly enough, but perhaps with a little too much bias, that many cases of supposed absorption of, and infection by, pus, originate in embolism, that is, the stoppage of some vessels by the coagula; and this view is certainly supported by the occurrence of many instances of apparent purulent infection, in which no primary deposit of pus can be found.

Thus the result of all these experiments upon the physical cause of purulent infection leads to the following very unsatisfactory conclusions.

Injection of pure pus into the blood produces in the great majority of instances no evil result whatever; when such occurs, it may arise, 1st, either from the mere presence of pus in the blood;[1] 2d, from the formation of clots on the nozzle of the injecting pipe, which, being carried into the circulation, give rise to embolism; 3d, from phlebitis set up by the mechanical injury of the vein.

Injection of putrid pus into the blood causes, in a larger percentage of cases, secondary abscess, but generally a set of morbid actions entirely different from those of purulent infection. The larger number of instances in which this experiment is followed by pyæmia, may be justly ascribed: 1st. To the coagulating effect which certain products of putrefaction exercise on the blood. 2d. The irritating effect of putrid matter coming undiluted into immediate contact with the coats of the vein, causing phlebitis.

The disease is occasionally set up where no primary inflammation can be found, and yet it is doubtful whether it can arise without a phlebitis, or at least the formation of clots somewhere in the circulation. Hence it may be due simply to embolism.

In spite of these extremely nugatory conclusions from all experiments I have had a strong desire to undertake a fresh series, and yielded in some measure to the temptation. My desire was to place pus in different conditions, from the perfectly pure and healthy to the most putrescent, not in a vein, but simply in contact with it,[2] then of employing other substances, lactic and hydrosulphuric acid, carbonate of ammonia, &c., in the same way, and carefully analyzing the blood in each case, whether any secondary abscesses were produced or not; but I have been deterred by considering the number of experiments necessary to produce any decisive results, the great quantity of time that must be employed, and the vast amount of cruelty to be involved. These experiments were the more readily abandoned because a careful observation of cases yields results which lead, if not to decisive conclusions, at least very near to absolute truth, and reveals that a certain condition exists which has not been noticed hitherto, and which is not producible artificially in the body of any animal. This condition is a certain state of system rendering it susceptible to the influence, whatever it may be, that produces the disease in question.

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[1] The first of these causes is almost proved impossible by the endurance of pure pus in the circulation without disturbance.

[2] Virchow, op. cit., p. 656, produced all the conditions of purulent infection by placing a piece of putrid fibrin in the jugular vein of a dog.

Every student knows that at times a dissecting wound proves dangerous, producing absorbent inflammation and abscesses, while at other times no evil results whatever follow. Every hospital surgeon knows, that while under usual circumstances he may operate on deep parts of the body—resect portions of bones, &c.—there come certain periods in which he avoids opening the skin as much as possible for fear of purulent infection, or erysipelas. Such occasional proneness to the malady is not only exhibited by a case here and there in one hospital at a time, but it may be in all hospitals at once, not only in London, but also in the provinces; and at the same time a low form of fever spreads among the students; and in private practice we find the same condition. Such a state is an element of the disease, which in experimentation cannot be disregarded, and no doctrine can be correct which refuses to acknowledge the circumstances, which render at one time the system prone to such maladies, or which at another protect it entirely.

The influence is evidently of the epidemic, or zymotic class: it affects a large number of people, and a large district; and there is present, at the same time, erysipelas, diphtheria, typhoid fever, or other of the lower forms of zymosis. Hence, it cannot be doubted that a large portion of this malady consists in a certain epidemic, affecting the blood in a peculiar manner.

Microscopic examination of the blood in purulent infection shows it to contain an abnormally large number of white corpuscles, which it can hardly be doubted were mistaken by Sedillot for pus-corpuscles. At the same time, the spleen is usually found enlarged, and either greatly hardened or softened. The blood has a particular tendency to form clots, which appear to consist rather of conglomerations of the white cells than of fibrinous concretions; but whether this state of blood be produced by a local condition, or whether that state produce the whole disease, general and local, is a question of some difficulty, although the epidemic tendency of the malady would lead to the latter conclusion. At all events, in those cases where purulent infection has followed a wound the annexed conditions will, I believe, be constantly found. A collection of unhealthy pus surrounding a vein, the inner coat of the vein inflamed, and containing a clot broken down, apparently suppurating, the pus inside being in a similar state to that outside the vein.

It has been asserted that the pus of secondary abscess does not contain perfect corpuscles, but that they are all broken down. I have examined pus from several secondary abscesses, and found that when it is putrescent, or very offensive, the pus-cells are, as a rule, broken down and imperfect, as the cells are found to be in any cavity containing such matter; but when the pus is not offensive, nor dark in color, its cells are perfect.

LOCAL SYMPTOMS.—The pain in joints affected by pyarthrosis is a severe aching, with sense of fulness and distension; it is aggravated by motion. The swelling does not, like that of simple acute synovitis, follow the shape of the synovial membrane; on the contrary, the tumefaction is more general, and has no distinct outline of commencement. The color is nearly always white; whiter than the normal hue of the skin; it has a sickly sodden appearance. In one case reported, that of Louisa Stonely, Case XXIII., the skin was red; but there were other anomalies also present that render this a doubtful instance; for example, there was no discoverable seat of suppuration. The subcutaneous tissues feel quaggy and sodden; late in the malady they pit. A practised hand soon distinguishes that a great deal, in some cases nearly all, of the swelling is external to the joints; sometimes the articular cavity contains, however, a great deal of fluid. In that form of disease called gonorrhœal rheumatism, the case often does not advance to the actual formation of pus in joints. The fluid effused into the cellular tissue is probably simply serum; at least we may so conclude from its subsequent absorption, but the joints are, in these cases more particularly, extremely white, which offers a strong contrast to the true rheumatic disease, in which they are red.

The surface over the affected part is hot, sometimes very much so if the case be rapid; but in the slower form which accompanies a gonorrhœa the temperature is often not perceptibly increased.

TREATMENT.—Upon the method of treating purulent infection from a wound, it is hardly desirable to enter, for it may hardly be considered as coming within the scope of this Treatise; but the differences of opinion regarding gonorrhœal rheumatism, as it is called, render its mode of treatment very various. As this variety arises from diversity of opinion in pathology, it appeared to me desirable to place it in juxtaposition with the malady with which I believe it to be identical.

Some surgeons conceiving that this is a peculiar metastasis of the gonorrhoeal discharge from the urethra to the joints, treat the disease with large doses of copaiba, and in the theory of such treatment lie two errors; firstly, in the pathology; secondly, in the idea that the balsam is a specific for such discharge. Others give colchicum, in the belief that the disease is a rheumatism.

Firmly assured as I am of its nature, I would recommend a stimulant and tonic general treatment, and locally mere soothing applications unless actual abscess be formed. Mercury and other lowering means are to be strongly deprecated. Purges are to be avoided except one at the outset, partly on account of their depressing influence, partly because we do not want to hasten absorption of the morbid matter, whatever it may be; the action of the bowels must of course be regulated.

Quinine is the remedy on which I chiefly rely in this disease; not merely the ordinary grain, or two grain doses, but large quantities; five, even ten grains at a time. It is hardly necessary to enter into certain other cases in which I have found three or four such doses act very beneficially, apparently by producing an action which is wanted in this disease. At all events, in two or three instances I have found it very valuable. One cannot talk with any propriety of *curing* a disease like this; the poison is actually in the blood; all that we can do is to support the system and prevent mischief while the morbid matter is being eliminated, and in some instances we can prevent the formation of more poison.

Ammonia and other diffusible stimuli are of great value. Wine, brandy, and diet may all be used to the same purpose.

Sedatives, chiefly opium, must be employed, if merely to prevent pain and irritation killing the patient. It is well, however, to watch the action rather jealously, for it must be allowed neither to depress the system nor to check secretion, by whose means the poison is to be got rid of.

In three cases of purulent infection I have tried the internal administration of chlorine; twice in the form of the liquor sodæ chlorinatæ; once in the form of chlorinated water. I am not sure of their action or inaction; two of the cases got well rather quickly, the other died. It requires more experiments and knowledge to fix their value or their want of value; my own impression is, that they are useful and have a decided action.

When the disease commences, its origin, unless clear and patent, should be sought. If it arise from a small wound or puncture, an incision that shall lay it widely open should be made, and chloride of lime or soda lotion should be inserted upon lint, and a poultice applied over this. The joint should be placed upon a splint; one that is as light and little annoying to the patient as possible; soothing application, poultices or lint dipped in warm water, and covered with oil silk, or cotton wool, are most comforting to the patient. When abscesses form, it is better not to open them while the patient's health continues in a very low depressed state, unless absolutely necessary. I have seen the bad symptoms greatly increase after such an operation. The pus in them is often in a very peculiar state, and the least admission of air causes rapid putrefaction. If an abscess must, however, be opened, the wound should be closed as soon as the pus has ceased flowing, and pressure by means of a bandage is to be applied. When, however, the pus is in a joint cavity, the earliest possible opportunity which the condition of health permits should be taken to evacuate the matter by a wide incision in the most depending part. Chlorinated soda lotion upon lint may be inserted into the wound, or indeed the cavity may be rinsed every day with that fluid by means of a gum-elastic tube and syringe.

Case XX.—E. B., aged 46, a healthy woman of nervous temperament, was admitted into St. Thomas's Hospital, 16th December, 1847, with a small aneurism of the right carotid artery about its bifurcation, and the common carotid was tied by Mr. Green on the 20th.

She went on very well for a week; the head symptoms merely amounted to a sensation; the wound suppurated freely; the pus was observed on the 28th to be rather dark in color.

January 1st. Mr. Green saw her, and himself dressed the wound; there was some discharge of pus, which, drying of a dark color on the skin, led to the supposition that it was blood; but a closer inspection corrects that error. She complained of a sense of stiffness between the wound and angle of the jaw, and this tract is tender.

Bowels confined—ordered to take at night pil. colocynth comp. gr. x.

3d. There is a rather copious discharge of a brownish-colored pus, but the wound is closing slowly by granulation. Although she complains of no pain, has had nothing to disturb her mentally, no shiverings, no bowel complaint or indigestion, yet there is something that renders her uneasy, morose, and discontented in manner. She repeated the colocynth pills last night, but the bowels have not yet been opened. Tongue white and dry. Ordered the following draught at bedtime:—

Mist. sennæ comp. ℥jss.

5th. Mr. Green dressed the wound, and could find no pulsation in the artery, either above or below the wound. Pulse 85, feeble.—Egg daily.

6th. Is very uneasy and dismal, her manner is quite peculiarly miserable. Pulse 90; tongue white; bowels still confined.

Mist. sennæ comp. ℥jss at bedtime.

7th. The medicine acted rather violently. The granulations of the wound are flabby, and the edges are red and swollen, and the pus is of a pale brown hue. She complains bitterly of pain in her left knee, but it is neither red nor swollen.

10th. In the same state; tongue, brown and dry; has very little appetite, and easily tires of any one sort of food; the ligature has lengthened from the wound; but, according to Mr. Green's directions, I did not pull the silk out.

13th. Yesterday Mr. Green withdrew the ligature, which offered no resistance; it had evidently, therefore, divided the artery on or before the 10th, that is, twenty-one days after the operation. She is to have a glass of porter daily.

15th. She is restless and uneasy; complains of her knee, but of no other pain; says that she feels confused and unable to think or control her mind; is very low spirited. The knee somewhat swollen; to be poulticed.

18th. Still in the same state of mind. Wound healthy and discharging freely. Pulse 95, feeble. She constantly bears an expression of countenance hardly to be called pinched, though it is something approaching that form. The mouth is puckered up, the lips compressed into an anxious expression; about the upper part of the face is a half frown, half sneer, either of pain or of discontent, or both. Pulse 95, feeble; voice weak and querulous.

23d. She is in the same low, desponding state. Pulse 100, weaker.

29th. Mr. Green saw her with Dr. Leeson; they did not form any conclusion as to what actually ailed her, but they agreed she was in a precarious condition. Pulse small, weak, and rapid; tongue, white. She begged that she might have treacle and brown paper applied to the knee; and it was allowed.

February 2d. Dr. Leeson has examined the urine, and found it loaded with lithate of ammonia and lithic acid. The knee is more swollen, otherwise she is in the same condition. I took some pains to see a relative of the patient to inquire about her peculiar manner. It appears that it has always been rather querulous and morose, but not, of course, to the same degree. The knee is more swollen and painful. She is to have two ounces of brandy, and, as diet, almost what she likes.

5th. There was found accidentally to-day a small abscess over the inner condyle of the humerus—she herself had not complained. There was likewise found fluctuation at the outer side of the left thigh; viscera of the thorax examined, were found healthy.

7th. Opened the abscess in the arm and let out an ounce of pus, which was examined by Mr. Simon and reported healthy.

9th. Four ounces of pus taken from the outside of the thigh; a little more came away during the day.

11th. The leg not much decreased in size, nor is there less pain. She is very low. Pulse 120, feeble; tongue, white or slightly brown.

Wine ℥iv, instead of brandy.

13th. Complains of pain in the head, also in the affected leg and arm.

Abscess on the arm smaller, and discharges; very little pus escapes from the abscess on the thigh.

15th. Pulse 110, irregular; tongue, white at edges, brown in the centre, dry, rough; skin, hot, dry.

17th. The last two days she appears a little better; but is now weaker than ever. Pulse 115, irregular, intermittent; tongue, as before, but tremulous; voice, very feeble.

19th and 20th. Lower still; pulse fluttering, and not to be counted.

22d. She sunk, and died at twelve A. M.

P.M. There was in the neighborhood of the wound a dissecting abscess with which the divided ends of the artery communicated by open orifices.

The artery remained open below the seat of ligature to within half an inch of its origin, where it was sealed by a plug of coagulum. Above the vessel remained open as far as the bifurcation, where it was closed by the coagulum, which filled the contracted aneurismal sac. The portion of artery below the ligature contained pus mixed with what appeared to be broken-down coagulum, while the part above the ligature was empty. The vein was closed at a point even with the aneurism by a thin plug of a bright golden-colored lymph, while it was plugged below by coagulum. The inner membrane of the vessel was covered by lymph of various colors, in different stages of decomposition. The vein between the two plugs of coagulum was filled with thick pus. On the inner and posterior part of the vein, on a level with the ligature of the artery, was an oval opening communicating with the abscess. This abscess extended downwards between the muscles to the pleura, in the reflected portion of which was an ulcerated opening about the size of a shilling, whose edges were adherent to the pulmonary pleura at the apex of the right lung.

Chest.—Heart and great vessels healthy. No appearance of general pleuritis. In the upper lobe of the right lung were numerous little deposits of pus, about the size of a millet seed, which might be called miliary vomicæ.

Head.—The ventricles of the brain contained perhaps a little more serum than in health. No difference could be found in the size of the two carotids; in fact, all else healthy.

Abdomen.—On cutting into the abdomen the only observable abnormal appearance was a fatty and somewhat enlarged liver.

Leg.—On cutting into the thigh and leg a very large quantity of dark-colored and very fetid pus escaped in a jet. This came from a diffuse abscess, which had separated, infiltrated, and partly destroyed all the muscles of the thigh and upper part of the leg. This abscess also communicated with the knee-joint, where the cartilages were all swollen and soft, and in many places eaten away, particularly at the posterior surface of the patella, which was nearly bare.

This case, at least all that portion which relates to the suppuration of the wound, and to its consequences, is copied in full from an old case book of my own, and is described simply as it struck one who had never seen such a malady before; it is perhaps the more interesting on account of the very simplicity and absence of all *arrière pensée* in the narrative. The peculiar manner, and the depression of spirits, are remarked upon and kept in view with a feeling of doubt, whether they were something peculiar to the woman, or were symptomatic of change in cerebral circulation, or were due to the disease. The whole case, more particularly the autopsy, is most interesting, and should be thus summed up.

A fibrous sheath containing artery and vein is opened, and a ligature put round the artery; the position of the patient, lying on the back with the head raised, is such as to prevent a free exit of pus, which was secreted at the bottom of the wound in the sheath of the vessels, probably remained there, or burrowed in the sheath; and eight days after the operation the pus is dark in color. On the tenth day the bowels are confined, and on the nineteenth is an observation of the peculiarly depressed and discontented manner, which never left her. It is remarkable that she had no rigors. Abscess in the thigh and arm formed during life.

The vein is found inflamed; the lymph which lines it is in various states of decomposition. Some pus which it contains is prevented mingling freely with the blood by plugs of lymph, but even these have undergone a certain form of decomposition, which renders them orange in color, and soft in texture. The odor of the pus in the femoral abscess is the same as, though less powerful than, that of the decomposed lymph in the vein. It is not possible to conceive that there were any local conditions in this case different to most ligature of arteries, in whose sheath the vein also is included; but some condition of the system evidently permitted the vein to become inflamed, and the clot contained therein to suppurate and putrefy, and to infect the blood.

CASE XXI.—Robert Heath, aged 15, had a small piece chopped off the end of his little finger with a knife; the bone was not laid bare. He came to the Charing-Cross Hospital 16th June, 1859, to be dressed.

30th. Came complaining of pain in the left knee, and said he felt very ill; had pain in the back and loins and head; had a shivering fit when he woke about three o'clock on the previous morning, and was sick once or twice; hardly slept at all last night; has no appetite; bowels confined; was taken into the house under the care of Mr. Hancock; the limb was put on a splint, and he had ten leeches applied to the knee. Mr. Hancock saw him in the middle of the day; ordered the following pill three times a-day:—

℞. Hydrarg. c. cretâ gr. iij.
Quinæ disulph. gr. j. M.

July 4th. The tongue is brown; the pulse small; skin, hot; he perspires; has no appetite. Ordered four ounces of wine, two eggs, daily.

7th. Leg more swollen; the swelling extends above and below the knee;

there is fluid, not only in the joint, but in the periarticular tissues, and beneath the fascia; medicine purges him a little. Add to to each pill

Opii pulv. gr. ¼.

18th. The whole left limb is swollen to a very great degree, so much so that it looks, in comparison to the other, gigantic; it is quaggy; pits. On the outside is deep fluctuation; an incision made through the *fascia lata*, about three inches above the knee; a great deal of pus escaped; urine loaded with lithates; tongue white, dry; he perspires profusely and wastes; pulse 110, thready. To take three times a day:—

℞. Træ. opii ♏iij.
Ammon. carb. gr. iij.
Decoct. cinchonæ ℥j. M.

Eight ounces of wine; eggs; chops.

Aug. 12th. The boy is getting weaker and weaker; Mr. Hancock determined to give him a chance of life by amputation. Operation performed this day.

I examined the limb minutely and will give a description of its appearances; it will be hardly desirable to follow the case further. The boy was hanging between life and death for a month after the operation: at last recovered. A curious circumstance occurred before he left; he had phymosis, and the penis was painful from irritation; had swelled once or twice; on examination some substance was found inside the prepuce. On slitting up the part there came out two lithic acid calculi, one about the size of a pea, the other a little smaller; it is probable that during the time he was in such a dangerous condition, these formed from the loaded urine in the place where they were found.

Examination of limb, August 12th, 1859. At the amputation a large abscess was opened, which was under and around the extensor muscles, and which reached two-thirds up the thigh. This abscess did not communicate with the joint, but it extended quite round the thigh, lying among and dissecting out the muscles; all the parts with which the pus came in contact were covered by a soft pultaceous pink tissue (a pyoyenic membrane), which, however, did not bind them together so as to form walls for the abscess.

The periarticular tissues could hardly be called thickened; they were covered, or partly converted into a soft material, such as above described. The joint contained a thick, greenish pus, here and there dark in color, without any shreds, and not offensive. The synovial membrane was red, in some spots claret-colored; its surface was covered, in great part, by a soft pultaceous tissue like that above described; this was most abundant in the subcrural sac, next about the alar ligaments; over the crucial ligaments there was very little, and here the membrane was most vivid in color. The patella was much encroached on by this material.

The cartilage of femur was ulcerated in a deep broad groove over the outer condyle; the edges of the ulcer were sharp in one part, where bone was laid bare; the soft tissue filled up the space. The patella had a broad groove of ulcer down to the bone, running transversely across it; many spots of cartilage on the tibia were discolored, but no others were ulcerated; the new tissue could be easily pushed back from all parts not eroded. Other parts of cartilage and the interarticular fibro-cartilage healthy.

The inner coats of arteries and veins were carefully examined; not a trace of inflammation could be found. A little clot taken from the popliteal vein contained many white cells; it was, to the naked eye, rather pale and colorless. The pus, both in the knee-joint and in the subfascial abscess, contained perfectly well-formed and normal cells. The soft tissue, both within and without the knee-joint, consisted of nuclei, round, oval, and a few fusiform cells, among which meandered some fine structureless membrane; the common form of new formations from connective tissues.

The next case is one in which a slough was established over a vein; purulent infection set in, from which the patient partially recovered, and no examination of the parts therefore could be made; but as the immediate cause of the disease the same condition of vein in all probability existed.

Case XXII.—Rebecca Caswell, aged 52, had a spot on the right leg which was inflamed, and which she feared would ulcerate; she came, therefore, on the 2d March, 1859, to the Charing-Cross Hospital, and Mr. Canton recommended that some varicose veins on the leg should be obliterated.

She was a healthy, muscular woman, above middle height, and said her health has always been remarkably good; complexion dark; rather bilious.

She was admitted on the 7th March, and on the 9th and three following days, four issues were made with potassa fusa, over as many venous branches; at the same time she was ordered to take, three times a day,

Mist. quinæ ℥j.

23d. The sloughs are separating, and she seemed doing well, but was last night seized with several severe rigors, followed by heat. To-day the tongue is brown and coated; pulse 100, hard; there are red lines running up the thigh to the groin; great pain in the right knee, which she described as coming on as though it had been struck.

Pil. calomel c. colocynth gr. v.

to be taken at bedtime, and the following draught to-morrow:—

Haust. cathart. ℥iss.
Eight leeches to be applied to the knee.

24th. The pain in the knee continued; it is swollen and slightly fluctuating; is very hot. To take the following draught every four hours:—

℞. Potassæ carbonatis gr. xv.
Potassii iodidi gr. vij.
Vini colchici ♏v.
Inf. quassiæ ℥j. M.

30th. The knee has become less painful, but the right shoulder is now attacked in a similar way, but less severely.

4th April. The pain in the left knee has ceased, and the swelling nearly so; but the right shoulder is worse, and the right wrist is painful.

13th. Has been in much the same condition; tongue still furred; pulse weak, 110. To take the following draught three times a day:—

℞. Ammoniæ carbonatis gr. iv.
Ætheris chlorici ♏xx.
Decoct. cinchonæ ℥j. M.
Mercurial plaster to the shoulder.

15th. The wrist more swollen.

Repeat the pill as on the 23d.

18th. Pain keeps her very restless. Add to the draught

Tr. hyoscyami ʒss.
To take one grain of opium at night.

23d. The left knee became very painful and swelled. Apply six leeches.

26th. The knee very painful, swollen, hot; the shoulder only now stiff. The right wrist swollen, painful, immovable; no alteration in color of any joint. Tongue still brown; eyes dull.

30th. In the same general condition. Right wrist is, she says, more swollen and painful; she complains to-day of the right knee, which, she says, is very tender. At a spot on the outer side examination showed that the tibio-peroneal joint was the seat of pain, and I think, also, of swelling.

4th May. The pain at the outer side of the knee has disappeared, but that at the wrist continues, and it remains swollen; tongue still brown and dry.

9th. In the same condition; sleeps but very little; tongue less brown; pulse 90, a little stronger.

11th. Both knees are again painful; I cannot find, however, that they are swollen, though they are hot.

13th. Knees still hot and painful; right wrist better; left wrist swollen, hot, painful; tongue brown; no appetite; very low spirits. The saphena vein, absorbents of the glands of groin, have all regained their natural state.

14th. I suggested to Mr. Canton the use of large doses of quinine.

20th. Has taken five grains of quinine thrice a day; is now up, and says she feels much better; does not look so lugubrious; tongue not brown, but still white; knees well; ankle better; pulse firmer.

23d. Has gone on with the quinine, and is much improved; the countenance is no longer depressed and dull, but clearer in color, and brighter in expression. The wrist is still a little swelled; but this seems only the remains of inflammation.

26th. The pains in the wrist and hand are better, and the tongue is cleaner, appetite better; she was, at her own request, discharged to go into the country.

30th. She goes to-day; I examined the wrist and hand, there is but slight swelling about them; movement of the wrist is painful, and there is slight crepitus; the knees seem recovered, except that there is a feeling of stiffness, chiefly in the right one.

In this case are the same set of symptoms, though less marked; the foci of inflammation did not form any abscesses, but are metastatic; there is the same depression of the vital powers. The effect of quinine in large doses is especially noteworthy.

The cause of this state is pretty evident. A slough is formed over a vein, of sufficient depth to cause inflammation of that vessel: the sloughs have not yet separated, but there is a slight discharge, and suddenly arise rigors, followed by the constitutional symptoms of purulent infection, and accompanied by absorbent inflammation, which latter fact marks the existence of a poison outside the vessels. The case, if compared, as to its causes, with the other, will be seen to be very analogous; inflammation of a vein surrounded by a morbid decomposed pus, is in both instances the primary cause.

The next case is less clear.

Case XXIII.—Louisa Stonely, aged 17, unmarried, a short slight girl of highly nervous temperament; she is a milliner, working in an airy room, but at the rate of twelve hours a day.

In the beginning of February, 1859, she was exposed to a heavy shower of rain, caught a severe cold, and was soon afterwards seized with considerable rigors; her teeth chattered frequently, and she had, alternately, a sense of heat and chilliness; she had exhausting sweats and aching of her limbs and loins, with headache and giddiness, great prostration of strength, and muscular pains over all her body. These symptoms continued for several days, when there commenced pain, with great stiffness in the right knee; this went off in about three days; she then got a bad sore throat which, she says, arose from swelling of the right side of the neck, which pressed on her palate; this state lasted a week; and then the right elbow-joint became extremely painful and swollen, and got continually worse for three or four days, and at last so painful that she came to the hospital on

Friday, 11th March. I saw her at that time and found the countenance anxious and flushed, the eyes suffused, unnaturally brilliant and restless; the pulse was rapid and feeble; the general surface cold; tongue furred, brown and much marked by the teeth; she seemed in great pain.

The elbow was swollen; diseased 11¾; sound 8½ inches; and red; very hot indeed, contrasting strongly with the chilliness of the rest of the surface. I sent her up stairs to the ward, and she fell under the care of Mr. Canton.

12th. To take the following every four hours:—

℞. Potassæ carb. gr. xv.
Potassii iodid. gr. viij.
Vini colchici ♏x.
Inf. quassiæ ℥j. M.

16th. Continues in much the same feverish state—is, however, weaker and altogether is worse.

Fish; rice to be added to diet.

23d. Worse, more feeble, and with as much fever; tongue brown particularly far back; elbow more painful. I suggested to Mr. Canto large doses of quinine, which were thus prescribed, to be taken three time a day:—

℞. Quinæ disulph. gr. v.
Mist. acaciæ q. s. M.

27th. Pulse better; countenance less anxious; she says herself that sh is better and stronger; but the arm is the same. Five leeches were ordere to be applied.

30th. General health improved; but the elbow is, if anything, more swollen and puffy; tongue cleaner.

April 2d. The limb starts now much at night, and she cannot bear it moved nor touched; tongue much cleaner; appetite improved.

13th. The starting of the limb has increased; also the tenderness of the bones, both above and below the joint. Empl. Lyttæ outside joint.

15th. Empl. Lyttæ inside joint.

16th. The pain in the joint is less and the starting has much decreased. She has caught a cold: to leave off the quinine. To take, every four hours,

Mist. pot. chlorat. ℥j.

17th. A point above the outer condyle has been more red for some time past, and now fluctuation may be distinguished in it.

20th. Fluctuation being now sufficiently distinct, a small incision was made, and a rather brownish-looking pus evacuated.

22d. The wound has discharged a thin pus, and the pain is relieved.

25th. The swelling diminished and the pain much less; no starting of the limb. To take six grains of the iodide of potassium and infusion of quassia every four hours.

From this time she gradually got stronger, and the swelling subsided. She left on the 17th May, in the following condition:—

The skin over the elbow still rather red and the joint shapeless: no heat nor tenderness. The forearm is still bent in the angle of the splint, namely, a right angle, and although it can be slightly moved from this position either way, the least bit beyond such slight motion is extremely painful, and causes contraction of the muscles; this limitation of movement is probably more due to muscular action and fibrous contraction than any change in the shape of the joint; there is no grating.

May, 1860. I saw this girl again; she had quite recovered the use of her arm, but seemed in a feeble condition, which, however, she says, is her usual state of health.

In all these reports, except the last, we find a wound which suppurates, followed by purulent infection. The last case is not so clear, because there is no evidence of suppuration anywhere in the body except at the elbow, which seemed secondarily affected. In the first two we find distinctly a vein bathed in putrescent, or at least in confined, pus.

There are a set of cases well known to the accoucheur, which Dr. R. Lee has taken much pains in investigating, and the following account is taken from his book on the subject: "In women who have enjoyed good health during pregnancy, and in whom the process of parturition has been easily accomplished, uterine phlebitis occasionally commences within twenty-four hours after delivery; the pain more or less acute in the region of the uterus, accompanied or followed by a severe rigor or a succession of rigors, suppression of milk, and lochial discharge, acceleration of the pulse, cephalalgia or slight incoherence, with most distressing sensation of general uneasiness, and sometimes by nausea, vomiting, and diarrhœa. These symptoms, after a short duration, are followed by increased heat and tremors of the muscles of the face and extremities, rapid feeble pulse, anxious and hurried respiration, great thirst, with brown dry tongue, and frequent vomiting of green-colored matter. The sensorial functions usually become much affected, and there is a state of drowsy insensibility or violent delirium and agitation, which is soon followed by extreme exhaustion. The whole surface of the body not unfrequently assumes a deep and peculiar sallow or yellow color, or a petechial or vesicular eruption appears on different parts of the body. The abdomen also sometimes becomes swollen and tympanitic, and some of the remote organs of the body, such as lungs, heart, brain, liver and spleen, or the articulations and cellular membrane and muscles of the extremities, suffer disorganization, from a rapid and destructive congestion and inflammation."

The following case from the same work is a good illustration of the disease:—

Case XXIV.—Mrs. May, aged 33, was delivered in the British Lying-in Hospital, 2d March, 1829, after an easy and natural labor. The placenta was expelled in a few minutes after the infant, and her situation seemed favorable until the third day after delivery, when a considerable discharge of blood from the uterus took place. From the 6th to the 20th of March she made no complaint of uneasiness in any part of the body though her strength rapidly declined. The countenance was of a dusky yellow tinge; the heat of the surface slightly increased; the respiration was hurried, particularly on bodily exertion, and the pulse was above 130, and feeble; the tongue pale and glossy, with total loss of appetite, though at no period was there any nausea or vomiting; bowels open; the uterus gradually receded into the pelvis, and pressure over the hypogastrium produced no sensible uneasiness. The milk was secreted sparingly; the lochial discharge had a peculiarly offensive smell. From the 20th to the 28th, when she died, the prostration of strength increased, and the pulse became still more feeble and frequent. The respiration was extremely hurried, and she was incessantly harassed with a hacking cough, and the expectoration of frothy mucus. The abdomen continued soft, flaccid, and not affected by pressure. She, however, during this period complained of excruciating pains in all the joints of the right superior extremity and in the right knee-joint, which was observed to be considerably swollen, but not discolored.

Dissection.—On laying open the abdomen the intestines and other viscera presented a perfectly healthy appearance, and the uterus was found reduced to its usual size a month after delivery. On careful examination of the peritoneal coat of the uterus, a slight adhesion was observed between it and the rectum on the left side. The uterus being removed, and its cavity laid open, a portion of what appeared to be placenta, about the size of a nutmeg, in a putrid state, was found adhering to its inner surface at a point corresponding to the adhesion between the peritoneal coat and the rectum. The muscular tissue of the uterus around this was of a dark color, approaching to black, and as soft as a sponge; on cutting into it about a teaspoonful of purulent matter escaped from the veins, and a small additional quantity was forced out of them by pressure; small coagula of blood and lymph plugged up the surrounding veins, and the spermatic and other abdominal veins presented no morbid appearance, and the uterine appendages were healthy.

On opening the capsular ligament of the knee-joint, where a fluctuation was perceived, about six ounces of thin purulent fluid escaped, and the cartilages of the joint were found softened and considerably eroded. There was no appearance, however, of inflammation external to the capsular ligament, and the femoral vein was healthy. The right wrist was swollen, but the structure of the joint was not affected; the cellular membrane around it was unusually vascular and infiltrated with serum.

Here again we have a case, and no difficulty would be found in quoting a series of such, where, after parturition, there is left behind a piece of placenta, whose putrefaction is followed by a low form of inflammation and suppuration in the uterus. In the peculiar condition of the part at the time the pus very readily putrefies, the veins inflame and exhale a similar matter, and all the symptoms of purulent infection, puerperal fever or puerperal rheumatism are produced.

By a curious analogy such disease is peculiarly liable to follow operations about the male perinæum, urethra, and prostate. It follows the operation for stone, cutting strictures from the perinæum, and even sometimes the violent and incautious introduction of a bougie. It is evident that the large veins which surround the commencement of the urethra and the prostate gland, also those which surround the uterus, are very liable to this form of inflammation, either on account of the depth at which they lie and the action of urine on lochia or pus, or the tortuous and sinuous formation of the veins themselves. If then suppuration in this portion of the body be so apt to produce purulent infection, and more especially the articular form of that disease, can it be wondered at that suppuration of the male urethra is occasionally accompanied or followed by pains and swellings of the joints, which have been, and often are still, mistaken for rheumatism? Indeed this disease goes by the name of gonorrhœal rheumatism, while it is in reality a slower form than ordinary of purulent infection produced by inflammation of the prostatic veins. I have no cases of dissection to prove this position; persons do not die under gonorrhœal rheumatism; but all the cases I have seen or read of go far to show the true origin of the disease; their course is not rheumatic; indeed the simultaneous affection of many joints is the only symptom common to this malady and rheumatic fever.

For one case of this description I must refer back to p. 46.

Case XXV.—George Henley, aged 25, came to me at the Charing-Cross Hospital March 5th, 1856, for a gonorrhœa. He had a good deal of inflammation, the orifice of the urethra looking very red. He had nitrate of potash, nitric ether, and hyoscyamus; in a week the inflammatory symptoms were so far checked that I ordered him an injection of sulphate of alum, two grains to the ounce. He went on very well; the discharge had nearly ceased.

28th March. Complains of pain in the knee, which is swelled. Two days ago, he informs me, he had a very bad headache and could not work, but laid down on his bed; shivered and felt chilly, and he has been very low and depressed; has no appetite; is restless and has bad dreams when he sleeps; tongue brown and dry; pulse quick, small, and low; bowels confined. He was ordered a dose of castor oil, and the same saline mixture as before.

31st. Much the same, except that the other knee is now swelled; both joints are very painful; they are not hot—are white; some fluid in the synovial cavity, but most of the swelling is due to œdema of the periarticular tissues.

Ordered poultices to the knees; to keep in bed; to take the following three times a day:—

℞. Quinæ disulph. gr. iij.
Acidi sulph. dil. ♏xij.
Spt. ætheris chlor. ♏xij.
Træ. aurantii ʒj.
Aquæ ℥j. M.

April 4th. Feels less depressed and has less pain in the joints; to take four ounces of gin in the day and one grain opium at night.

7th. His knees are both better, but the right wrist is now swollen; he complains of a headache and giddiness, due, apparently, to the quinine; the tongue is still brown; the pulse is 90, small, and compressible. The following is ordered to be taken every four hours:—

Mist. ammoniæ sesquicarb. effervesc. ℥iss.

11th. The swelling of the knees much less; the right knee, that last affected, has chiefly diminished; the wrist the same; tongue rather cleaner.

16th. He is altogether better; the pulse is stronger; but he now complains of pain in the left ankle.

22d. He has come into the hospital.

I was unable to follow the minutiæ of this case further: he ultimately got well, with a certain amount of stiffness in the left knee, which had remained most obstinately affected; the same tonic and stimulant form of treatment being continued.

CHAPTER V.

STRUMOUS SYNOVITIS.

PATHOLOGY.

NATURE is said to abhor a vacuum; but her abhorrence for a sharp boundary line is more violent; thus, though in zoology, botany, or any other natural science, the typical examples of facts may be strongly marked, the less choice instances lose their distinctive clearness, till at last, in the lowest specimens, the demarcations become more and more obliterated, so that the savant hardly knows whether the nameless thing he is examining belongs to his own subject or to his neighbor's. Thus it is with different forms of disease; an inflammation of any part may be evidently simple, or evidently strumous; or what is quite as common, it may lie on the verges of both. We have already seen that simple chronic synovitis is a slower form of the acute; we will now follow out the history of the strumous form, pointing out those signs which most powerfully mark its constitutional origin.

A patient scarcely, if ever, dies just as a chronic inflammation is beginning in an important joint, so that we very rarely get the opportunity of examining the synovial membrane, under the first attacks of such a malady; but occasionally it happens that a limb must be amputated for diseased ankle, or wrist, and we may then find among the tarsal or carpal joints, one or more laboring under early stages of disease; and again, by comparing symptoms with what we know of the later stages, it is not difficult to obtain a reliable history of the complaint from beginning to end.

A chronic synovitis may be an oft-recurring sequel of a previous acute attack, or it may commence at once as a chronic inflammation. The cases in their pathological anatomy differ little; but one has rather the start of the other, as it commences in a part already thickened and weakened by disease; yet, on the other hand, any inflammation which commences without adequate local cause, in a chronic form, in some deep part of the body having no communication with the exterior, is always of a constitutional character, and is sure therefore to be more difficult to deal with, more deeply-rooted than an inflammation owing its origin to some mere fortuitous circumstance.

At first the very same processes, which take place in an acute inflammation, are found also to go on in the chronic, but much more slowly, viz., hyperæmia of the synovial membrane, and a secretion into the joint, of a fluid, which becomes more or less fibrinous; then arise granulations from the synovial membrane, thickening of the subsynovial tissue, and inflammation, &c., of the cartilages.

When we have an opportunity of examining a joint, which has for some time been affected with strumous synovitis, we find, and are principally struck with, a peculiar thickening of the synovial membrane. The cavity of the joint shall be much encroached upon, shall have almost disappeared, the synovial membrane being thickened, both internally and externally, by a gelatinous, soft, pulpy material, of a light brown or rose color, which, in the lowest forms of the disease, has a greenish look in the shadows, and where the light comes through its translucent substance. The amount of this growth is not always the same: sometimes it is not more than half an inch in thickness, and the joint cavity, still large, is full of badly-concocted pus; in such cases a different, a purulent form of inflammation has succeeded to the action which caused the thickening. I have had many opportunities of examining typical cases of this strumous disease, and will relate one of its most striking instances that have fallen under my notice.

Case XXVI.—Phœbe Hope, aged 9, was admitted, under Mr. Hancock's care, into the Charing-Cross Hospital, 22d April, 1856, with a far advanced strumous disease of the knee. Owing to the state of the patient's health and other causes, the limb was amputated on the 3d May.

3d May. I examined the limb. On dissecting up the patella and opening the joint no cavity could be seen, except two small spaces, whose position and size will be described immediately. The whole space between the skin and these cavities appeared converted into a light brown jelly, intersected here and there by thin, white, fibrous, glistening bands, marked by small wavy vessels, and spotted by specks of extravasated blood, of a hue somewhat darker than that of the veins. The interarticular cartilages could not be found: the external ligaments of the joint were only visible as scattered white fibrillæ separated from each other by the gelatinous tissue; the crucial ligaments were in a similar condition. On each side of these latter structures, and of the mass of jelly which inclosed them, was a pyriform cavity; the larger part, which would admit the finger, being situated in front, some distance from the patella, the smaller end running backward and a little outward; they were in shape like the lateral ventricles of the brain without the descending cornua; they contained pus, and the smaller end communicated with abscesses, under the corresponding heads of the gastrocnemius muscle. There appeared to be no communication between the cavities, nor between the abscesses. The gelatinous matter was in places immediately under the skin, and was generally about two inches thick; not so much at the back, more at the side of the patella. There was no trace of articular cartilage on any of the joint-surfaces; but the jelly-like material appeared to arise equally from the synovial membrane and from the otherwise bare cancelli of the femur, tibia, and patella. A section across the ligamentum patellæ presented the cut ends of the fibres separated from each other by the same gelatinous tissue; they seemed swollen and sodden. Examined by the microscope, this substance was found to consist of a number of nucleated cells, round, oval, and fusiform; of bare nuclei, and of granules. Most of the fusiform cells were arranged in lines, three or four cells broad; the cells lying end to end, or, rather, with their thin ends just overlapping the similar extremities of their neighbors to the right and left. These lines of cells crossed and recrossed each other, forming irregular spaces, in which the round cells and other constituents of the tissue were stored. The white bands presented simply a fibrous appearance, and were much tougher than any other part of the tissue.[1]

It was explained in Chapter II., that besides mere liquid and fibrinous effusion into the joint, there takes place an action even in acute synovitis, which could only be compared to that of granulation. The jelly-like material just described, results from the same process; but, in acute and healthy inflammation, the tissue organizes itself more fully, and is developed into a fibrous or imperfect areolar tissue, which, if the person entirely recover, will, after some months, become more perfect, until it would not be distinguishable from healthy, but thick, tissue. In a typical case of strumous joint disease, the newly-formed matter remains always in the state of granulation; it does not contract; it does not form fibres; it never advances beyond the first form of crude-cell structure, such as has just been described. Between these two conditions innumerable gradations may be found. French authors, Velpeau,[2] Bonnet,[3] Richet,[4] and others, describe this strumous disease as "*tumeur fongueuse;*" the last author divides synovial inflammations into pseudomembraneuses and fongueuses. Sir B. Brodie[5] termed this latter "a morbid change of the synovial membrane;" the only real difference is in the degree of development, which the granulation undergoes, and an inflammation, marked by more or less full development of the inflammatory products, may take on the fungous form; or a disease of this latter sort may assume a power of development, and become "pseudomembraneuse." Thus, a scrofulous ulcer, or a large wound, may, after going on well for some time, throw out large flabby granulations, which will not harden, nor form a sound tissue, but which, after another interval, may, more or less suddenly, contract into small florid granulations, succeeded by development of tissue and cicatrization. It will be well to remark, that these changes follow variations in the health of the patient. Thus, as said above, innumerable gradations will occur in joint diseases, not only in different cases, more or less decidedly strumous, but also in the same case, as the health of the patient may vary.

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[1] For an account of a microscopical examination of a similar condition, see Dr. Handfield Jones in "Pathological Transactions," vol iv.

[2] Velpeau, Dictionnaire, en XXX. vols. Art. "Articulations."

[3] Maladies des Articulations.

[4] Richet "Sur les Tumeurs Blanches." Mémoires de l'Académie, tome xvii.

[5] Diseases of Joints.

The granulations arise, both from the free surface of the synovial membrane, and from the subsynovial and periarticular tissues. Those which arise from the free surface commence by a slight increase in the villous roughening of the membrane, rendering it like the mucous coat of the small intestines, or like the palpebral conjunctiva, when it is slightly granular.[1] These villous or granular processes increase in size, and in this form of disease assume a conical shape, with broad bases, and but slight projection, the bases unite, as do the granulations of an ulcer, and constant growth thickens the membrane in the concentric direction. Like the hyperæmia, this tissue is most developed where the membrane is loosest; and as in all joints very loose folds overhang the cartilages, it is here that the greatest growth takes place, and overlaps those structures; may even creep over them, and unite across them, covering them with a reticulation of new tissue. At first, and until the cartilages become diseased, these new formations may be pushed away with the feather of a pen, or the tip of the finger, and beneath them the cartilaginous surfaces are found in parts quite healthy, in parts opaque, and dead white, in parts actually grooved. The new tissue has been supposed to absorb the cartilage;[2] we shall see in the proper place in what the action really consists.

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[1] This latter comparison is made by M. Richet, op. cit.

[2] Aston Key "On Ulceration of Cartilage." Med.-Chir. Trans., vol. xix.

The essence of this growth is a change in the mode of development of the epithelial cells. Under the irritation of the disease these bodies fall off, and there are developed instead, from the basement membrane cells, which have not, like the epithelial, lost their generative power, and which, therefore, constantly produce new cytoblasts. By this means many of the villous-like processes and their secondary sacculi become matted together, while some grow and shoot out across the joint; at first, in a reticulated form, supported on the cartilage; subsequently, as they increase in breadth, they unite laterally, and become layers of false membrane. Thus, by the constant formation of new cell-layers, internal to those previously developed, the cavity of the joint is more and more diminished. Under this action the basement membrane loses its peculiarity, of allowing no vessel to pass, and minute tortuous capillaries are prolonged into the older layers of the tissue. The newer parts have less color, are less firm than the older, and contain only round and oval (no fusiform) cells, nuclei and granules. Many of these bodies are shed into the joint as pus-cells, where, continuing to multiply, they render the fluid more and more puriform.

This species of action, as it takes place upon serous membranes, is described by Rokitansky, under the name of Tissue-vegetation (*Gewebsvegetation*). Subjoined is his account of the process.

"A second portion of the products of the inflamed tissues (*serous membranes*), the 'Gewebsvegetation' (*Tissue-vegetation*) must be distinguished from exudation, and arises in consequence of effusion into the subserous tissue. It consist in a growth from the basement membrane of masses of cells, in a vegetation of round, oval, and fusiform cells which dissolve themselves into a hyaline mass, and become areolar fibrillæ. Examination of this material on serous membranes offers the most and richest explanations on the origin and development of this vegetation. On the serous membranes arise layers of round, oval, and fusiform cells of $\frac{1}{50}$ millimetre in diameter, with nuclei of $\frac{1}{100}$ millimetre. They grow out of the membrane in the form of a delicate villous covering, papilla-like granulations, or of branching and anastomosing folds, and give to the surface its well-known dull velvety appearance. At the same time the serous membrane loses its fibrous texture, and assumes a hyaline gelatinous consistence. The vegetation forms itself into a simple or an interrupted lamella, or into a network, and these again give origin to new masses of cells, of fringes, papillæ or bands. In this way are piled up simple or looped lamellæ or network; these last intermingle freely, whereby a change into fibrous connective tissue advances from the older to the newer strata. The nutriment for this continuous vegetation is derived chiefly from the vessels advancing into it from the serous membrane; but some portion of it may be borrowed from the exudation contained in the cavity within the growing formation. The growth, when the blastema (histogenetic material) dissolves, is reduced into a serous fluid."—*Lehrbuch der Pathologischen Anatomie,* Band I. s. 136.

Besides this vegetation on the surface of the synovial membrane, there takes place in the subsynovial areolar tissue an action, which is in reality the same occurring under somewhat different circumstances. This similar action on the subsynovial textures is a vegetation of cells in the meshes of the areolar tissue; it takes place in every mesh around the synovial membrane, beginning at first in the parts close to the basement-structure, and spreading gradually outwards, centrifugally; it fills the areolæ with, and at last converts the tissue into, a translucent and gelatinous mass. The growth takes its origin from the areolar-cells (see Chap. I.), and is similar to the process whereby loss of substance, open wounds, fractures of bones, divided tendons, &c., are repaired—similar therefore to granulation, which can only take place by the agency of connective tissue, and in the places where it abounds.

Mr. Paget has given an account of the glazing of the surface of open wounds. "Blood gradually ceasing to flow from the surface of such a wound, one may still see some blood-tinged, serous-looking fluid oozing from it slowly; as this becomes paler, some of it collects like a whitish film or glazing on the surface; and this, if it be examined with the microscope, will be found to contain an abundance of the white corpuscles of the blood imbedded apparently in a fibrinous film. The collection of these corpuscles on the surface of the wound, especially on wounded muscles and fasciæ, appears to depend only on their peculiar adhesiveness. One sees them adhering much more firmly than ever the red corpuscles do to the walls of the minute bloodvessels, and to the glass on which they are examined; and so on cut surfaces, while the other constituents of the blood flow away, the white corpuscles, and probably also some of the fibrin, quickly coagulating, adhere."[1]

These cells, which are supposed by Mr. Paget to be white blood corpuscles, are, I believe, formed by and from the areolar cells—bodies which we know to possess nuclei, and to have a generative power. If we have an opportunity, which frequently occurs in a hospital, of examining a wound inflicted a few days before death we shall find the areolar cells in the neighborhood enlarged, filled with granules, and if acetic acid be added their nuclei will be found evident and large. This is not the place to give a full account of this process, as it occurs in all the connective tissues throughout the body. I must refer the reader to my paper in Beale's Archives of Medicine, "On Granulation," &c.; but it may be said here, that these areolar cells enlarge, fill themselves with nuclei, and granules which pass through the cell membrane, and escape into the areolar meshes, and there go on multiplying until each mesh is filled by them and their progeny. This view gains great support from the actions which take place in bone cells under inflammatory disease, actions which can be followed with much more readiness than in the areolar tissue; the cell-changes in ulceration of cartilage also support this principle, since the three tissues and species of cell all belong to the same class—to the connective tissues (Donders' *Bindegewebe*).

As this process goes on, the basement membrane disappears, the fibrous structure of the areolar tissue itself changes, and all the textures involved become simply a jelly-like mass. The cells, in which the growth takes origin, lose their existence; as do all such bodies when they produce a plentiful progeny, and the fibrous (intercellular) parts of the tissue are eaten up, and absorbed into this superabundant growth, as is the law in all long-continued inflammations of the connective tissues. The more recent parts of this growth, that is both the inner and outer layer, consist entirely of round and oval cells, and bare nuclei. The older portions possess also a number of fusiform cells, which arrange themselves in line intersecting each other, so as to form a network. This is a commencement to the regeneration of areolar tissue; the lines of fusiform cells may be seen in different stages; in some those bodies vary but slightly from the oval form, having still a considerable circumference in proportion to their length; in others the cells become longer at the expense of their breadth, acquire taper ends, and at last become mere cell-fibres. If the process be tolerably healthy, the formative action goes on until a real, but clumsy, areolar tissue is formed comparable to the cicatrix of a wound; but if the action be modified by struma, or indeed by any advanced debility, the granulation does not advance beyond its crude gelatinous condition. Between these two many gradations exist, creating differences in the more or less marked scrofulous type of the particular case.

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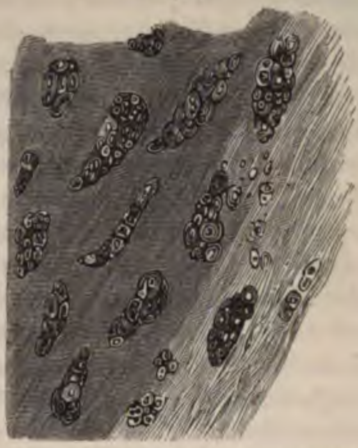
[1] Paget's "Surgical Pathology," vol. i. p. 201.

While this inflammatory action on the synovial membrane is proceeding the cartilages become diseased. The subject of ulceration in these structures has been already in part discussed (Chap. II.); and it was affirmed that the changes therein are, like the changes in the other structures of the joint, due to inflammation; it is true that the cartilaginous inflammation is a secondary action, but it is not true that its ulceration is due simply to passive erosion of the cartilage, as the growth of certain mosses and lichen may eat away the stone from which they sprout. The course of the morbid action is as follows:—

As granulations form on the internal surface of the synovial membrane, they, lying thickly on the synovial fringes, overlap the cartilage more or less. About this time appear in that structure some slightly elevated spots, which have lost their brilliant polish and translucent appearance, and have become of a dead dirty-yellowish hue. These specks may be in any part of the cartilage, under the thickened fold of synovial membrane, or at its edge, or in the centre of the joint-surface, where no false membrane as yet exists. If a section be made perpendicularly through one of these spots, it will be found to be conical in shape, the base being at the free surface, the apex deep in the structure of the cartilage. The depth, at which the apex may be, increases with the age of the disease; sometimes there is a very perceptible breadth of apparently healthy cartilage between it and the attached surface; later the cone is truncated by the bone.

If the section be examined by the microscope, it will be seen that, at the diseased part, the cartilage-corpuscles have become much larger, and the cells contained in them have also greatly increased both in size and number, each one being provided with a number of nuclei, and having become more or less granular; some of them also contain oil-globules.

Fig. 6.



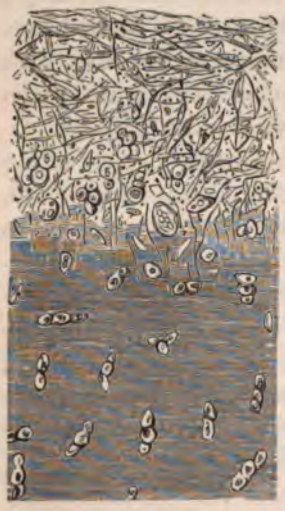
Section of strumous ulcer of cartilage, magnified 500 diameters.

This disturbance of the usual condition commences below the part which looks to the naked eye diseased; but becomes more and more marked towards the free edge of the section, where many of the swollen corpuscles lose their distinctness of outline, and even coalesce. The indistinctness of outline is owing, according to Rokitansky and Weber, to the gelatification of the hyaline substance, but this assertion requires proof: it is certain, however, that during and in consequence of this alteration of the cells, the hyaline substance becomes obscurely granular, striated, and fibrous; it also assumes a yellowish color.

The free surface of these unhealthy spots, examined by the microscope, presents a rough uneven aspect, full of irregular depressions and equally irregular elevations. The depressions are formed by the rupture of swollen corpuscles, and the elevations, which are fibrous or velvety, by the projection of the altered hyaline substance. Scattered over this surface are many cells, with several nuclei, and more or less granular, some of which are undergoing further changes, becoming fusiform or even stellate.

These spots may occur in any part of the cartilage, either at the edge overlapped by the false tissue or in the middle of the joint, where two surfaces of cartilage are in actual contact, no false tissue intervening, or in any part of the incrusting material which granulation has not yet reached; again under this tissue the cartilage may remain for the most part healthy, and in these places the whole zone of false tissue, with its ramifications and its plexus of vessels, can be lifted entirely from the cartilage, wherever that structure has remained sound; but, wherever it has undergone the alterations already described, there occurs a peculiar adhesion between the two tissues in a manner now to be explained. As the ulceration continues it approaches more and more the attached surface, the hyaline substance becomes fibrous over a greater area and in greater depth, the corpuscles increase in size and burst, discharging the cells into the surrounding structure, in which many apparently empty rifts and chasms are perceptible. The direction of these cracks appears peculiarly arbitrary; some of them run with the fibres, others directly, others obliquely, across them; many of them terminate at either end more or less abruptly; but some of them, and this of course depends upon a fortunate position of the section, are seen to diverge from a centre larger than any one of the branches, which are themselves larger near the centre than towards their termination; the whole shape is like that of a crack or star in a pane of glass, produced by striking it with any small object. On examining this stellate rift more closely, it will be seen to be granular throughout; on applying dilute acetic acid the granules fade, and in the centre of the star one or more nuclei will become evident. In fact, this apparently empty space is not empty at all, nor is it a series of cracks in the hyaline substance, whose directions are accidental. It is a stellate cell developed from one of the cartilage cells, that had been scattered from a ruptured corpuscle, and which is in form and size exactly like one of the cells so characteristic of areolar tissue. In fact, the cartilage has slowly undergone a transformation into a form of granulation, or into nascent areolar tissue, and at the same time there has occurred, between the structure thus formed and the similar material growing from the synovial membrane, an adhesion or interweaving which becomes more and more intimate until at last it is mere continuity. It is this condition which led Mr. Aston Key[1] to ascribe the ulceration of cartilage to the action of a rodent tissue growing from the inner surface of the synovial membrane, which gradually absorbed the cartilage, supposed in this instance to be perfectly passive.[2] A clearer knowledge, however, and a closer study of the phenomena lead us to the truth that the cartilage is ulcerated by an action or

Fig. 7.



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[1] Med.-Chir. Trans., vol. xix.

[2] It is singular how pertinaciously many surgeons have clung to the view that cartilage is a merely passive material, in spite of Mr. Goodsir's and Dr. Redfern's

actions of its own, and thus we come back as nearly as possible to Sir B. Brodie's opinion. This celebrated surgeon so clearly saw that this was the case, that in order to explain its possibility he had to insist on the presence of vessels, because non-vascular parts were supposed incapable of inflammation. As, however, it can now be certainly affirmed that any part which is capable of nutrition is also capable of inflammation, it can, I submit, be no longer denied that cartilage is liable to be inflamed, and consequently ulcerated, whenever an inflammatory disease attacks the other structures of the joint.[1]

It has been said that during this process many cartilage corpuscles burst on or near the surface, discharging the cells among the fibres of the altered hyaline substance, and into the joint cavity. We have in the present chapter traced what becomes of them in the former situation. In Chapter II. we found that the cells which are set free into the joint cavity continue to multiply there as they did in their natural situation, and contribute to the formation of pus.

The cartilaginous inflammation is accompanied by a hyperæmia of the vessels beneath the articular lamella, which any one may determine for himself who will take the trouble to split several bones, over whose extremities the cartilages are ulcerating. Thus, although it is certain that what is called vascularity of a tissue is not necessary to confer on it a power of becoming inflamed, it is equally certain that when a tissue makes increased nutritive demands, increased supply will be brought to it. Hence the vessels supplying an inflamed part will become hyperæmic, whether they be situated actually in the part or at some distance from it.

If the whole cartilage, as well as the synovial membrane, were thus changed into granulation tissue, and they became united toge-

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investigation into their changes. As late as 1853 M. Richet, de l'Hôpital Bon Secours, published a paper "On White Swelling," in the Mémoires de l'Académie Impériale, in which he says "that the only direct manner of proving that cartilages are susceptible of inflammation would be to demonstrate vessels in the substance itself." It is not necessary to refute an argument which bears its fallacy so openly. The Guy's School of Pathology follows, however, M. Richet in this instance, and even in its last production carries the same argument further. Mr. Bryant says "they" (the cartilages) "may undergo *hypertrophy* and *atrophy*, using the latter in its simpler sense. Inflame and ulcerate they cannot, as the presence of vessels in the tissue is generally considered necessary for such processes." That is, they may undergo all the actions of inflammation, but they cannot inflame.

[1] See papers of mine "On the Articular Cartilages" in the Brit. and For. Quarterly, Oct. 1859, and in Edinburgh Monthly Journal, Feb. 1860.

ther as just described, the joint would be obliterated, and if the new material should then contract into a tough fibrous substance, the disease would terminate in what is called false anchylosis. But it very rarely, if ever, happens that the cartilage over the whole surface is thus uniformly altered; on the contrary, it is usually affected very deeply in certain parts, before it begins to be diseased in others; hence the inflammation spreads at these points more rapidly to the bone, which in its turn becomes inflamed. Inflammation of bone is the same action, whether it begin primarily in that tissue or spread to it from another structure, and in the chapter on osteitis these actions will be fully handled. It must, therefore, suffice to say here that as bone is a connective tissue, having cells and intercellular substance, and as it is a tissue which once was cartilage, its actions would be presumed, on *à priori* reasoning alone, to be similar to those of like structures. Indeed we find, in caries and suppuration of this material, that the cells in the lacunæ grow and generate at the expense of the intercellular parts. By this process the cancellar plates, which support the articular lamella, after a certain time give way. This, of course, occurs soonest at those parts which have first become inflamed, namely, at the spots whence the cartilage has been ulcerated. Therefore, very soon after such ulceration has reached the bone surface, the lamella powders away in little prisms.

But the bone inflammation, having once been set up, spreads laterally so as to be going on beneath portions of cartilage, which have not been eroded on their free surface. In such spots, also, the articular lamella, after a time, gives way, and the cartilage becomes detached not from, but with, that structure.

By these actions the cancellous cavities are laid bare to the joint, and from their lining membrane, as well as from the bone cells themselves, sprout up granulations, which unite with those from the synovial membrane, wherever they come in contact with them. Wherever, on the other hand, the lamella and cartilage have been detached complete, these two form a barrier between the new tissues from bone and synovial membrane. In the examination of joints that have long been the subject of strumous synovitis, such detached pieces of cartilage are frequently found in a more or less advanced stage of fatty degeneration. The deep surface (formerly attached) of these pieces of cartilage is rough and gritty, like sandpaper, from the remains of the articular lamella, now dissolved by loosening of the tubular structure into a series of prisms, one of whose ends remains adherent to the cartilage. The fatty degeneration (a constant accompaniment in connective tissues of insufficient nutrition) which the cartilage cells of these fragments undergo causes the intercellular material to become fibrous; but this is a very different fibrification to that described as a result of inflammatory disease, and the fibres never commingle with those of the granulations from the synovial membrane; the degenerated cartilage always remains unattached.

Having now followed up these three processes, viz., granulation of the synovial membrane, alteration of the cartilage into nascent areolar tissue, and sprouting of granulations from the bone, we must continue to trace them in their further development, both progressive and retrogressive. The condition to which we have brought all these parts is as follows: The synovial membrane, including much subsynovial tissue, is overgrown by a mass of granulations, perhaps two or three inches thick, the cartilages and articular lamella have disappeared, and from the cancelli grows out a similar granulating structure. These two masses of granulation matter, united at the edges, inclose a cavity, containing pus of a more or less perfect sort, which in all probability finds exit along one or more sinuses traversing the tissue. Now this condition is simply that of an abscess which is becoming filled up. It is evident that when once the joint as a frictionless apparatus has been destroyed, nature aims at obliterating the now useless or rather injurious cavity: she does this by just the same process, whereby she fills up any other cavity, accidental or diseased—by granulation and cicatrization. But this false tissue may act in several ways: firstly, it may simply continue to grow in circumference centrifugally without increasing centripetally, more and more of the periarticular tissues becomes involved, but the cavity remaining open and suppurating; secondly, it may degenerate in several parts, causing fresh suppurations in the cavity and abscesses in the substance itself of the false tissue; thirdly, it may both grow and contract towards the centre, fill up the cavity, and unite the bones. Of the first of these there is pathologically nothing further to say; it is simply a continuation of a process already described. The second set of actions are degenerative. The transition from a round granulation cell to a pus cell is very small, and such change frequently takes place in this new tissue; the same ultimate end also is produced by the fatty degeneration which large portions of the mass may undergo. By either process abscesses are produced[1] which increase constantly in size, destroying more and more of the material whereby ultimate union might otherwise be obtained. It is a great error to look upon pus as the destructive material; it is the result, not the cause of tissue-solution; how otherwise could an abscess gradually contract, squeezing out more and more of the fluid until its walls can come in contact and unite? The reason why it is necessary to let out pus is that the walls may come together; for as long as the granulation represents surface not in contact with a similar texture many of the cells which grow from that surface will form into pus-cells, whereas they might otherwise unite with the opposite wall and form tissue. Hence, after opening an abscess we put on a compress to keep the sides of the cavity in contact. The proportion between the amount of pus and the amount of granulation is very variable, in different and even in the same case. In very cachectic cases the tissue has not power to remain, but the inner cells melt away into pus, and thus we have a larger abscess and cavity, and less fungous tissue than in Case XXVI. An examination of such a joint is given at the end of this Chapter (see Case XXXV.).

Fatty degeneration is not infrequent, and may last long before it produce abscess. In examinations of gelatinous tissue not yet suppurating there may be found many spots where the microscope clearly reveals this retrograde action. Such spots are generally lighter in color than the rest of the tissue, are straw-colored, and it may be a question whether a diffuse suppuration at these places have not already begun; certainly in spots with a light greenish tinge, which I have once or twice seen in the substance of the gelatinous tissue, a very large proportion of the cells had more the appearance of the pus-cell than any such bodies in other parts of the growth—possessed several highly refractive nuclei.

It occasionally, though rarely, happens, and then only when the strength of the patient has been very much reduced, that the whole tissue at once suffers from fatty degeneration. There then occurs a wide-spread unhealthy suppuration, great loosening of the joint, and necrosis of the cancellous bone structure.

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[1] It would occupy too much space to show how a mass of cells, becoming fatty, deliquesce and leave a cavity partially filled with oily matters, and how the cells formed on the new surface thus produced fall into the chasms and become pus-cells.

Occasionally, in the midst of this new granulation tissue, little spots of tubercle (miliary tubercle) will be found, but these formations are rare. Some misconception generally prevails as to the influence of tubercular matter upon disease, and it seems to be frequently considered as the cause of the inflammation, and of the secondary changes. I am by my own observations convined that Virchow is right in looking upon tubercle as one form of cell degeneration.[1] This is, however, hardly the place to enter into the minute pathology of tubercle; suffice it to say that it is produced in these new tissues from the cells, that it is only one form of the alterations they will after a time undergo, and that it does not produce the granulations, but is formed from them. They are therefore not a cause, but one of the products, of strumous synovitis. The tubercle is simply one of the degenerations which the new tissue may undergo.

The third process is the means whereby union between the bones is produced. The masses of granulation from the osseous, synovial and subsynovial tissues, having intermingled, inclose a cavity which contains pus. In the weaker states of system this cavity does not decrease; it rather increases, because many of the new cells formed on the inner surface become pus-cells; but when a little more power is acquired, these bodies remain and assist in the filling up of the space, until they grow across the cavity and unite with its opposite neighbors; at the same time and also in consequence of increased power, the whole mass of granulations undergoing further development becomes more fibrous and contracts centripetally. By these means the pus is squeezed out of the cavity, which becomes obliterated, and the bones are now joined together by a solid fleshy mass which, as it consolidates, contracts more and more, after the manner of all cicatrices, and draws into closer contact, not only the bones themselves, but the skin over them. This is the reason why a joint anchylosed after a strumous synovitis is often smaller in circumference than its healthy fellow.

In course of time, when the limb has been kept perfectly still, the fibrous tissue, which sprouts from the cancellar walls, begins to be studded with minute points of phosphate of lime, and so become gradually bony. The process radiates along the fibrous growths from each bone: in fact, they grow along the tissue until the process at one end comes in contact with that at the other. Thus all the intersecting net-like fibrous elements are converted into bone; the whole forming a meshwork of thin osseous plates inclosing cavities, therefore a structure perfectly similar to the cancellous portion of bone. Indeed the demarcation between the one bone and the other becomes obliterated; even when the consolidated mass is split, no line of junction can be found—the two are fused. When the whole fibro-cellular mass has been thus ossified, the anchylosis is called a true one. Sometimes portions of the false tissue will be converted into cartilage previous to ossification; but this is a mere accidental condition, is not essential to its conversion into bone, and rarely takes place in strumous disease.

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[1] Cellular Pathologie, p. 422.

SYMPTOMS.

Among these we must include not only the local signs of inflammation, but also that general condition which would lead us to pronounce the disease scrofulous or otherwise. It must be remembered that we have to deal with a state which may be firmly fixed in, and produced by, a highly depraved habit of body, or with one which, commencing in some exciting cause, puts on just sufficient slowness of action and other generic signs to warrant its inclusion under the head of strumous inflammations. In making this distinction at the bedside, we are guided not by local signs and history of the case alone, but also by the general appearance and conformation of the patient.

The strumous diathesis has been the subject of much thought and care; many writers and lecturers detail certain complexions and other signs whereby they believe themselves capable of detecting this taint, that is to say, of detecting a tendency to certain forms of malady. Many of these signs are, I believe, fallacious, and the rest are not diagnostic of the constitution, but of strumous disease actually commenced, and then present. Fine light hair and blue eyes are said to be marks of the strumous diathesis, but quite as much and more intractable forms of struma occur in individuals with thick swarthy complexions and coarse dark hair. I know some families, one more particularly, all of whose members have remarkably fine light hair and light-colored eyes, yet in which no scrofulous disease can be traced for generations back. The mode of growth of hair scattered far forward on the temple, low down on the nape of the neck, and ending in a soft colorless down, is said by some to be a sign of the strumous taint. I conceive this notion rests upon far too slight a basis to be seriously considered as a means of diagnosis. Again it has been affirmed that thickened finger ends and hooked nails is a marked sign of strumous disease, but careful observation has convinced me that any malady producing violent protracted cough will impress this form upon the nails. Phthisis produces it, and therefore this idea of its strumous origin has become prevalent; but asthma will also cause it, and I watched for many months a patient who was suffering from abscess of the liver opening into the lung, whose nails became more hooked and finger ends more clubbed as the cough continued and increased in violence. The patient has recovered, and has for some years coughed hardly more than any healthy person, and the nails have gradually resumed their former shape.

Other appearances, to be immediately specified, are not so much evidences of a strumous constitution as of a malady then present. Struma consists in a state of bad nutrition, and of this evil action the appearances are the outward signs; the symptoms of a morbid action then going on, rather than of one about to begin.

Such defective nutrition gives rise to two sets of appearances, each remarkable for itself and for its distinct separation from the other. The former is marked by a peculiarly large and sluggish pupil, most observable when, as is often the case, it is combined with a light-colored iris; we know that an iris of such hue should be extremely rapid in its action, because the small amount of pigment renders the eye more sensitive to light.[1] The white of the eye is in these cases of a bluish-pearly hue, marked by the passage of one or two wavy vessels. The skin is often remarkably clear, with a cold bluish tone in the very transparent shadows that makes it look translucent. There is often a pearly tint about the upper lip and corners of the mouth, which beauties of the old French court tried to imitate with powder. The veins, in certain parts on the upper eyelid, about the temple, and across the lower jaw near its angle, are very visible, making purple markings under the skin. The temples are thin and clear; the cheeks, defined in outline, have a soft bloom upon them, while red and brilliantly tinted lips add to the whole richness and delicacy of coloring. Bredow,[1] a Russian physician, observes on the great beauty of this aspect, and at the same time on the tranquillity, almost impassiveness, of most "parts of the face, which takes its frequently spiritual expression chiefly from the eyes." It is beauty, but of a peculiar sort, which, together with the tranquillity and stillness of the face, reminds one of that bloom which, we know, often revisits for a few moments the features of the dead.

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[1] Hufeland, "Ueber die Natur der Skrofelkrankheit," has remarked that this peculiarity of eye is in children an accompaniment of mesenteric disease.

Another type brings with it ugliness of the coarsest description. The head is large and angular, bigger behind than in front; the ears are big, puffy, shapeless, and project from the head; the jaws are prominent; the nose swollen, and its cartilages ill-defined; the lips thick and shapeless; the hair coarse, dull, either dark or of a disagreeable red; the conjunctiva of a dirty-yellow and muddy appearance; the eyelids thick, swelled, and red, even when free of inflammation; the lash ill-developed and scattered; the complexion dull and opaque; the skin coarse, unctuous, and marked with large orifices of sebaceous ducts. The figure is ungainly; the limbs unwieldy; the joint-ends of the bones, the hands, and feet are large; the belly prominent.[2]

Now in both these cases the morbid appearance is not one of mere complexion—both forms may be either dark or light; it is one of defective nutrition. In the former all the connective tissues are too thin and fine, their powers of nutriment are insufficient; thus the coats of the vessels are so thin that the blood is seen through them; and in persons thus constituted, hemorrhages occur from the mucous membrane without the presence of any ulceration, but simply because they are not strong enough to resist the pressure from within. In the latter case we have a clumsy, thick set of connective tissues; they possess sufficient nutritive and but little formative power; hence the fibrous, cartilaginous, and other intercellular parts, are (instead of being too fine or deficient) too large; but they are at the same time ill-concocted, soft, flabby, and sodden, refusing or sluggishly accepting the last and completing acts of their development.

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[1] Bredow, On Scrofula and its Dependent Diseases.

[2] Kortum (Commenta de Vitio Scrofuloso, 1789, an admirable treatise) mentions cracking of the upper and lower lips in the median line, and of the former over the inter-maxillary juncture; and if this be combined with the puffiness above mentioned it may also be enumerated as additional evidence, but neither its presence nor its absence is of importance.

The descriptions are of course taken from the strongest example of each type; but observation will, I am confident, show that one or the other form is always a prevailing mark of struma. These appearances are in reality signs of strumous disease then going on, and consisting, as that malady always does, of defective nutrition in the connective tissues. Such a state produces a tendency to chronic inflammations of the parts it affects; but it does not merely produce inflammations, it modifies them also, rendering them very slow, insidious, very obstinate, and very liable to end in suppuration or in degeneration of tissue. This is in accordance with our ideas of a constitutional disease; and if struma be a defect of the whole nutrient system, causing ill-performance of interstitial nutrition, it follows that an inflammation, which is an exaggeration of this latter process, must be impressed, even in an exaggerated degree, by those functional faults.

When, therefore, a patient with a swollen joint presents himself to our notice, and we find the above-named signs of actually present strumous disease, we may fairly conclude that the inflammation also, if chronic, is strumous; but we have no right to form that conclusion simply because the hair may grow far forward on the forehead or low down on the nape of the neck, or because the patient has light hair and blue eyes.

The history of the case will aid us very much in forming a correct judgment. A chronic synovitis may be the residuum of an acute attack, or it may be a relapse after the patient has appeared well. The former of these is very probably (unless much prolonged) due to no constitutional taint. If it have recurred without apparently sufficient cause, or if after exposure to fatigue or cold, it may be either strumous or rheumatic;[1] the latter, if the primary attack have been acute rheumatism. But if the disease have arisen by a painless or nearly painless tumefaction around rather than in the joint, and have remained constantly chronic, it is nearly always strumous. It must be remembered that although an acute synovitis is never scrofulous, it may leave a strumous inflammation behind it; for the strumous cachexia is especially a chronic condition; when an acute inflammation is by any accident set up in a strumous person, the acuity completely masks, if even it does not altogether overpower, the cachexia:

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[1] The diagnostic signs are given in the sequel.

thus a wound of a scrofulous person, not in the last stage of the evil, heals as well as it could do in a sound individual; the inflammation is acute, and healthy tissue is produced: so in an acute synovitis; but as soon as the inflammation declines and falls into the chronic or even subacute stage, then the cachexia can exercise its power, and the malady becomes scrofulous.

The second form of commencement, that in which a chronic synovitis commences after some slight accident as a more or less painful disease, is generally the way in which the strumous form begins in the adult. But the very worst history of any case, that which shows the greatest force of constitutional evil, is the commencement as an utterly painless swelling that does not prevent the patient moving about as usual; and these instances are generally those most sluggish and inveterate ones that form the "Morbid Alteration of Structure" of Sir B. Brodie.

CASE XXVII.—E. Campbell, aged 10, came under my care at the Charing-Cross Hospital, August 14th, 1858, for diseased knee-joint.

She is a very pretty child, with well-cut features, dark eyelashes, and blue eyes; has no swelling of the lips, nor of the nasal cartilages.

The swelling of the knee was only observed by the mother three days ago, but the child herself says that she has known of it for much more than that, but it did not ever hurt her, and does not now: she plays about as well and gayly as usual.

The knee is swollen; round in shape; the swelling soft, and with a fluid sensation; there was a little tenderness to the inner side of the patella, but this was very slight, and only mentioned when the child was questioned. Ordered a splint and perfect rest; tincture of iodine to be applied every morning; quinine and cod-liver oil three times a day.

On the 16th August she first complained of pain, and the knee became more swollen. Ordered blister above the knee, to be dressed with simple ointment.

24th. The swelling is increased and the pain is greater: when she first came to me the knee was about a quarter of an inch larger, in all dimensions, than the other, now it is an inch and an eighth larger. The swelling is round, shapeless, and indistinctly fluctuating: the mother was at last persuaded to leave the girl in the hospital, but she was so unhappy that she was fetched out again in a day or two.

Sept. 3d. Having an interest in the case I continued to see her out; she has been going on much the same: three days ago a blister was ordered, and the right knee to-day is decreased; the left is painful and swelled, but not the least hot. Ordered two grains of gray powder every night.

8th. The swelling of the left knee increases; that of the right has diminished: it is no longer fluctuating, but has a more solid, a semi-solid feel.

13th. She is pale and languid; both legs on splints; appetite very low. Two days ago the powder was discontinued; the oil is to be left off. Syrup of the iodide of iron 30 drops thrice a day.

Having to go out of town, I left especial directions as to the management of the patient, and the name of a gentleman who would see her, if required. On my return, I was shocked to find her very much worn and exsanguineous. The knees are in just the same state; contain no fluid apparently, but present a soft pulpy swelling.

The rest of this case may be gathered in the one word, consumption, which was making rapid progress when I last saw her.

In Case XXVI. (p. 114), that of Phœbe Hope, whose leg was amputated for strumous disease of the knee, the disease had begun four years before, in a swelling, which the mother observed accidentally, and the child ran about for six weeks afterwards, as well, says the mother, as ever.

Both these cases, commencing painless, end badly. The one develops the constitutional root in a vital organ; the other remains local, but so deeply rooted as to resist all treatment.

The local symptoms of this disease require careful consideration; and that we may the more surely attain a proper description, we will divide it into three stages of pathological progress, and give the symptoms proper to each.

Firstly.—The inflammatory and granulating processes.

Secondly.—The cartilaginous and osseous inflammation.

Thirdly.—The consolidating and degenerative processes, one or both.

The first of these is simply "the head and front of the offending;" the others are conditions, into one or both of which the malady may fall after an indefinite time. The object of such division is not only that the disease may be recognized as it appears, but also that those symptoms may be comprehended, which point out its tendency to a spontaneous cure by anchylosis, or to destruction of the part by suppuration and degeneration.

First Stage.—*Swelling* may come on with or without pain, and the latter condition is, as we have seen, the less favorable. In some cases swelling does not begin till a day or two after pain has been felt, and then the patient, sometimes justly, sometimes otherwise, refers the disease to a slight accident. In this latter case the swelling will at first have much the form of the synovial membrane; but this condition is very short, and corresponds only to the few days, when there is some increase of fluid in the joint, and very little new tissue in and around it; in this state the swelling fluctuates slightly. Some time after the disease has begun in this manner, the joint may actually decrease a little in size, and the tumefaction left will be no longer fluctuating, nor so soft as previous to the diminution. Instead of conveying to the practised finger the sensation of confined fluid, it gives that of a soft solid; the decrease, under these circumstances, is of no good omen; the fluid may have almost disappeared, but there has been instead, formation of gelatinous tissue. From this time the joint will continue more or less gradually to swell, the shape of the tumor becomes very different to that of an acute synovitis; its chief characteristic is that of shapelessness; its form is not affected by the position of tendons or of ligaments; but it includes them in its vague boundaries.

The sensation which the tumefaction conveys to the hand is soft and boggy, such as, to the uneducated finger, may give the idea of fluctuation. Many parts of the swelling are softer, and some parts harder, than the general mass. These soft spots are not more truly fluctuating than the others; the increase in softness is all that can be observed about them. The harder parts seem to lie in the mass, to have no defined boundaries, and cannot be separated, be lifted up, or be seized by the fingers. The surface of the joint becomes, by degrees, whiter than normal. This symptom is the more marked, the more strumous be the case, so that we may roughly conclude on the degree and mode of granulation in the new tissues, by the whiteness of the tumor. This symptom has endowed a large class of joint diseases with the name White-Swelling, a name which, in its translated form, "Tumeur blanche," is now more used in France than in England, its native country. When the case is far advanced, this whiteness is very striking; for as the swelling increases, the skin becomes stretched, polished, and of a dead-white hue, through which tortuous flattened veins meander. The whiteness will aid in the diagnosis between strumous and malignant disease, in which latter the skin is usually of a brown, almost coppery hue.

Heat is, if present at all, confined to the first few days of the complaint. In the best forms it may indeed last longer; there may, perhaps, be a suspicion of increased warmth throughout the attack, but in the generality of cases the temperature is not raised, and in the worst, those in which the swelling is most white, polished, and undefined, it has seemed to me that the surface was colder than natural.

Pain.—At the commencement of the complaint, there may be, as we have seen, no pain; if, however, this symptom be present, it takes the form of aching, to which afterwards a sense of distension is added. It is to be observed, with regard to this latter feeling, that it is of a passive character, there is no throbbing or bursting, as is complained of in acute synovitis, or in abscesses; moreover, this pain is influenced much more by the position than by the actual use of the limb. If the disease be in the knee, the mere erect posture which keeps that joint low will produce as much pain as walking about. In a case of the disease in a finger, the patient, a cigar-maker, was ordered to rest; he left off his work, at a rather high table which kept the hand elevated, and neglected to keep it in a sling, but let it hang down. He then complained that resting hurt him more than working; the pain came on in the evening, and was absent in the morning. A short sling, keeping the hand high, changed entirely these conditions. This influence of position is more marked, and more unmistakable in the worst forms of cases. Sometimes a sensation in the joint of intense cold is cause of great complaint. The symptom is very variable; in some cases altogether absent, in others slight, in others most acute. I have a case at the present time[1] in which the patient speaks of this pain with great dread. He says that the other pains which he suffers are bad, and may keep him awake, but this sensation of cold is so *horrible* that he has sometimes felt as though he could tear the limb out of its socket. Burning pain is mentioned by authors as one of the concomitants of this disease. I have found patients, when questioned, acknowledge that the joint was hot; but I have never found any complain of their own free will of painful heat. It is difficult, or perhaps impossible, to assign a sufficiently proven cause for this cold sensation; it may be that the growth of a badly organized material starving the healthy parts may produce this feeling in them; but such supposition is mere theory. The sensation should, however, be regarded as of evil prognostication; those cases in which it has been most intense have been invariably, as far as my experience goes, the most obstinate, and the most prone to degeneration.

SECOND STAGE.—When the disease has continued an indefinite time, varying from a few weeks to some months, a different species of pain comes on. It is described by the patient as "gnawing pains," "soreness of the bone," "starting of the limb at night."

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[1] November, 1858.

These sensations have been supposed to be caused by an ulcerating process going on in the cartilage; and so indeed they are, but only in a secondary manner, for the pain is directly produced by the hyperæmia in the subarticular vessels of the bone, caused by the cartilaginous inflammation. Cartilage, either healthy or diseased, possesses no nerves, the only conductors of impression to the brain; therefore, when inflamed, it is as insensible as when not inflamed; but hyperæmia produced thereby, in such an unyielding structure as bone, sets up these painful symptoms.

Another sensation, attributed with equal want of precision to ulceration of cartilages, is tenderness on pressing the joint surfaces together. The origin of this symptom, although extremely obscure, I believe myself to have detected. By questioning minutely for years past every patient that came in my way, by observing the species and succession of different sensations, and examining, when possible, the joints of those whose symptoms had been thus noted, I have come to the conclusion that this tenderness indicates, that the articular lamella has given way over a larger or smaller extent, and that the cancelli are laid bare to the joint. The actual sequence of events can in most instances be traced, the starting-pain coming on first, two or three weeks, or even more, before the tenderness supervenes. Having examined a very large number of joints, in all sorts and conditions of disease, and having, wherever it was possible, compared the symptoms with the morbid anatomy, I can affirm, that I have never heard complaint of this peculiar joint tenderness without finding the articular lamella broken through. I have found the lamella given way in cases where there had been no joint tenderness; but then the breaches of continuity had been either very small, or situated in some part where, in the position of the limb, it could not be pressed upon by the other bone of the joint. Grating or bony crepitation in the articulation is a symptom which, when it occurs, proves an ulceration of cartilages, throughout probably a considerable extent of both bones; but the absence of this grating by no means proves that the cartilages are sound, for granulation from the bone may be so luxuriant as to prevent the two osseous surfaces coming in contact. It not unfrequently happens, that during some part of the progress of the case, the bones will grate, and that afterwards they will altogether cease to do so. The reason of such cessation is, after what has just been said, perfectly evident.

The constant gnawing pain, and the chief shock of the startings, are in each joint referred to some especial spot, which is so invariably the same as to be remarkable. At the shoulder this spot is in front, just below the acromion; in the elbow at the back, where the radius is jointed to the humerus. At the wrist it is at the back, outside the extensor indicis. At the hip, if there be pain at the commencement of the disease, it is situated on the inside of the thigh, just behind the origin of the *gracilis;* afterwards it shifts and fixes itself behind the great trochanter.[1] At the knee, it is situated at the edge of the trochlear surface of the femur. At the ankle, in front of and below the external malleolus. Although to these rules an exception may here and there occur, it is so unusual as not to interfere with their practical value. The most patient examinations have led me to no discovery of the reason why the pain should be thus referred to particular spots; we must at present be content to accept the simple fact. While these starting pains, &c., occur, the limb exhibits a remarkable tendency to deformity from contraction of muscles. In another place we have spoken at length, concerning the causes of this action (see Chapter XI.); in the present instance it must suffice to say, that the nervous susceptibility of joints, which permits hyperæmia and inflammation of the sublamellar bone-cancelli to produce starting spasms of the muscles, also allows the same causes to bring about a more regular and more constant retraction of those organs. It is difficult, or more correctly, perhaps, it is impossible to say why in this action the flexors should predominate, and why, therefore, the limb, if left to itself, should be gradually more and more bent up. At the knee, where this disease is most common, the action of the flexors prevails over the extensors to such an extent that the joint becomes bent at an acute angle. In very little time after such position has been assumed it becomes permanent, and the retracted muscles hold the limb firmly in that posture; any attempt to straighten it produces great pain, and the tendons can be felt tight, and like cords under the skin.

When inflammation of cartilage and bone comes on, the case assumes symptoms referable to this latter disease, which override and mask those of mere synovitis. The one may nearly always be distinguished from the other, even in the later stages, by the greater size and encroachment of the soft swelling, by the less implication of the bone, and less predominance of the osteitic symptoms; still they are generally alike, and the reader will find a more detailed account of this diagnosis in Chapter XI.

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[1] For further account of hip-joint disease see chapter on that subject.

THIRD STAGE.—The above are symptoms, in the first two stages of strumous synovitis, of the growth of false tissue and disappearance of cartilage and its bony lamella, provided no degeneration or any other disease of the morbid growth occur. If such should happen we shall find the symptoms to be now detailed added to those already specified. It is not absolutely necessary that the new tissue should degenerate or suppurate at all, but it was pointed out in the pathological division of this chapter, that the gelatinous matter cannot for ever abide in that form, but will ultimately take a course either towards organization or towards disorganization. It is rare that some at least of the material does not take the downward way, and in those cases, where the generative function of the cell has been excessive, and the membrane therefore very thick and pulpy —in those cases which we have placed in the worst category—a great part of the false tissue is predestined to degeneration unless prevented by treatment.

If then the tumor of the joint do not diminish, but continue to increase without sign of active inflammation; if the joint become loose from relaxation or destruction of the ligaments, we may feel assured that degeneration and suppuration will probably occur; if the skin become whiter and more polished, and lose its mobility, while the tumor continues to enlarge; if the soft mass feel as though it were immediately beneath the surface, we may conclude that those retrograde actions are imminent, or perhaps have actually begun. And if a portion become quickly softer, even without fluctuating, we know that at that spot degeneration has set in.

The symptoms of these actions differ sufficiently in their amount and place to enable us to diagnose with considerable accuracy what is the occurrence then going on. It must be remembered that suppuration may arise in the substance of the tissue, or in the still remaining cavity, or in both. Small abscesses in the thickness of the soft tissue occur in almost every case; no special symptom marks their formation, except that when they get near the surface their fluctuation is pretty evident; such abscesses may or may not communicate with the joint cavity, and after they have opened on the skin they soon degenerate into sinuses. The formation of a large abscess is marked by more than usual depression of constitutional power, followed by additional pain in some part of the tumor with increase of size; soon after the skin at that spot reddens, then the abscess points, and is incised or bursts. Such a collection of pus usually opens into the joint cavity as well as externally. If the purulent matter be gathered into the cavity and have no exit, it will cause a sense of distension and throbbing, with vague pains about the limb; if the collection of pus be sufficiently considerable to produce pressure, and if it have formed quickly, some feverish symptoms will probably occur. The tumor increases in size, but not in the same manner as when the abscess is in the substance of the tissue, for then the addition is confined to one side, to one part of the tumor; it is general when the abscess is in the joint-cavity, the skin over the whole mass becomes more markedly white and pearly, before one spot, where the abscess will point, shows a red blush. The choice of this spot is not merely a matter of chance, for every joint has a favorite locality for the discharge of pus, so that the first opening which is made for this purpose nearly always occurs at the same place. This is more remarkable in the deep-seated joints, the shoulder and hip; the choice locality for the former is just inside the biceps, below the pectoralis major muscle; for the latter, behind the great trochanter. So fixed are these places that we might conclude, if a first abscess open in an unaccustomed spot, that it was formed in the substance of the false tissue, and it may or may not have communicated with the joint; but is far less likely to do so than if it had opened at the usual place. When a suspicion arises of abscess in the substance of the tissue from a great increase of softness, it is better not to open it until the skin become red and very thin, partly because no good is produced by so doing, for the pus does not cause pressure, and it has been already pointed out that pus is not the solvent but the solution of the tissues; and partly also because it is sometimes impossible to be quite sure that the sensation is due to a collection of pus. In one case I was tempted to open what I believed to be an abscess, the fluctuation was unmistakable, no pus came, the wound bled freely, until a compress was applied. I procured a little piece of the soft tissue, and on putting it under the microscope found that the cells were very large, filled with oil, and there were a great number of free oil-globules among them.

If the subject be in a strongly-marked strumous condition, or if he fall into considerable cachexia, suppuration in the cavity and in the new tissue will go on simultaneously, and spread further and further. All those cells in the focus of suppuration, which can be converted into, or generate, pus-cells, are thus affected; those parts involved within the circle of suppuration which cannot be thus employed die; thus, if ligamentous fibres be so included, they slough and their *débris* will be found in the pus. If an abscess be formed in the soft tissue which fills out the bone cancelli, all the little plates of bone which surround those cavities, and are included in the area of suppuration, necrose bit by bit (necrosis insensibilis), and come away as a fine detritus mixed with the pus. These actions are not, in this ill-conditioned state, confined to the tissues immediately about the joint, but a slow wasting suppuration occurs among the deep muscles; such abscesses are often hardly bound in by any pyogenic membrane, and they diffuse themselves further and further from the origin of the disease; they nearly always communicate with the joint.

We have seen that the ligaments are, like the rest of the periarticular structures, involved in the new tissue formation, which has taken place between their fibres from the cells imbedded in their substance, and that these fibres are partly changed, partly spread out by this growth. It happens that, so long as the material remains in its passive stage, the joint will not be very much loosened, and we do not find that any such loosening forms one of the symptoms of this disease in its early condition. But when these retrograde processes come on, the tissue gets soft, suppurates, and destroys all the parts, which it incloses, and thus the articulation becomes extremely loose; at the same time the articular surfaces alter in shape, so that they oppose no resistance to any new posture. The joint becomes capable of almost any abnormal movement; the tibia, for instance, may be rotated on the femur; the ulna may be shifted from side to side over the trochlear surfaces of the humerus. In this condition of joint, and while the muscles are subject to the spasm above mentioned, it is not surprising that the bones should be dislocated by muscular force. The tibia is sometimes drawn back by the action of the flexors; the radius upwards by the biceps. The displacements, however, are rarely total; part of the new surfaces, hardly now to be called articular, rest against each other. Thus, in a case I had the opportunity of watching, the outer condyle of the femur rested on the inner articular surface of the tibia.

Such luxation is followed by a remarkable remission of all the symptoms, particularly of that starting pain which produces so much distress. This circumstance strongly corroborates the result of my investigations into the causes of the starting and of tenderness of the joint surface.

The relation of these symptoms to the dislocation is as follows: Entire cessation of pressure of one articular surface upon the other causes utter cessation of the starting pains. This point is of so great importance both to the semeiology and to the treatment of articular diseases, that I am anxious to lay great stress upon it, and to impress it strongly upon my reader's mind. Be it, however, observed that spontaneous dislocation of a joint cannot occur till after the stage in which the articular cartilage with its lamella are either entirely or in great part removed.

Anchylosis may commence, when the cartilages and articular lamella have been destroyed, without any great production of abscess in the joint cavity or periarticular tissues, or it may occur after these have formed and have been discharging. Also after partial dislocation anchylosis frequently sets in. Its first sign is cessation of increase, indeed actual decrease, in the size of the swelling, which at the same time becomes firmer, while the skin, losing its white hue, assumes more and more its natural appearance. The mouths of sinuses, which may have formed on the surface of, or at some distance from, the joint, and which are crowned with large flabby granulations, begin to contract. The granulations first become smaller and less vivid in color, the redness of the skin immediately surrounding them declines, the discharge diminishes. At length the granulations sink to a level with the surface; they appear to be sucked in, as a snail into its shell, and at last the opening closes altogether, the tumor diminishes, and hardens more and more, and the shape of the bones again becomes visible. In cases that have been remarkable for a great amount of puffy swelling, and in which the soft mass has been immediately beneath the surface, the contraction during the progress of anchylosis is so considerable, that the circumference of the articulation becomes at last actually smaller than its fellow of the opposite limb; and the skin is girdled in between the bones. The posture becomes more fixed, and the health greatly improves. This whole process is simply analogous to the contraction and healing of an abscess.

There is no reliable symptom whereby we may determine the commencement of ossification in the bond of union, *i. e.*, the beginning of the change from false to true anchylosis.

TREATMENT.

General.—It perhaps hardly comes within the scope of the present work, nor is it otherwise advisable, to enter into any long treatise on the treatment of struma. Yet it is evident that, in dealing with a disease, which takes root in a certain state of system, all attempts at cure would be fruitless, unless some means were employed to alleviate the constitutional evil. In the first place, all hygienic measures must be taken—close dwelling-rooms are to be ventilated; light admitted to the fullest possible extent; unhealthy diet changed, and cleanliness inculcated. Upon these plain rules of living we need not linger.

Two different aspects of strumous disease were described at page 130, with some care, because they ought to indicate two different forms of treatment. The distinctions, although frequently as strongly marked as there indicated, do not always diverge to that extreme degree; therefore, the treatment to be described for each will not always be so opposed; but their principles may be somewhat intermingled.

That form of scrofulous disease, which is marked by thick unwieldy connective tissues, is in adults very generally, in younger persons invariably, combined with a sluggish intestinal canal, accompanied usually in the latter instance with threadworm. The whole tube is lined by a thick viscid mucus, which does not stimulate the peristaltic actions, nor permit either food or remedies to come in contact with its mucous coat. This matter must be purged away, and the best means for the purpose is a powder of calomel and jalap or calomel and rhubarb. In another chapter (see Chapter XI.) the action of this remedy in articular disease is compared with its effects in strumous ophthalmia. We can, in this latter malady, actually see the morbid symptoms decline as soon as the intestines are clear. In strumous synovitis the benefit is not less certain, though it may be less plainly perceptible. In one or two cases of commencing strumous joint disease, the exhibition of this remedy, combined with suitable local means, has checked the complaint. It not unfrequently happens, that after the medicine has had its due effect the complexion will resume its muddy hue, and the eyelids become again red; the dose should then be repeated;

but proper dietetic and medicinal measures will prevent the necessity of recurring to the purge more than once or twice throughout the whole complaint. Small alterative doses of mercury may, however, be given for a day or two with advantage. This medicine is not in these cases to be pushed to any point near affecting the gums; it is simply to correct the secretions, and is the more beneficial if it produce rather free action of the bowels. For this purpose, it may be advantageously combined with quinine; as, for instance, two grains of the gray powder with one of quinine, night and morning for two or three days, and then the latter may be administered alone twice or thrice in the twenty-four hours.

Iodide of potassium is especially indicated; it may be given in some bitter infusion. I have been in the habit of using the following formula, a little altered from one of Lugol's, the action of which is quicker than the iodide alone:—

Iodide of potassium, 1 drachm.
Pure iodine, 2½ grs.
Infusion of calumba, 1 pt.

It is singular that the addition of the pure element detracts from the metallic taste of the compound, and renders it less lasting. The formula appears, in some of the reported cases, as the mistura potassii iodidi composita.

Quinine, mineral acids, and bitters, are the tonics most beneficial in this form of the disease. Iron is far less valuable, and cod-liver oil very frequently disagrees, besides aiding the tendency to clogging of the intestines and sluggishness of the liver.

The form of struma, which is distinguished for the fine delicate formation of the connective tissues, is to be managed on a different plan. Purges and mercury in any form must be avoided; the inaction of the intestinal canal is to be combated by mild vegetable aperients; rhubarb given in pill immediately before or with the last meal at night is an excellent plan, and anything like a violent or irritating evacuant does harm. Iodide of potass in the most typical cases of this sort of struma is not beneficial; the whole class of alteratives are not needed.

On the other hand, tonics are extremely valuable. Cod-liver oil is especially indicated, as we desire increase of nutriment; in these cases it very seldom indeed disagrees. Quinine, if the appetite fail, is useful; but iron is to be much more highly prized; in fact, I esteem steel and the oil as the best medicinal agents: where the latter has been found unsuitable, sarsaparilla may be advantageously administered. Malt liquors, milk, if possible cream, should be included in the diet. It may be pointed out that in these cases the stomach is usually capable of managing only a little food at a time; therefore, the meals should be small and frequent. I have often found that these patients are very languid in the morning, feel faint, and are not able to eat breakfast; on inquiry, it will often be elicited that they take no food, after a meal about six or seven in the evening, till breakfast time; an interval often of fourteen or fifteen hours, which is more than their powers will bear. They may be told to eat a piece of bread and butter about half an hour before going to bed; they will then not only sleep better, but wake less languid. When there is much debility I have found advantage from ordering something before rising in the morning.

The value of all treatment lies in its adaptation to the particular case. The distinction between the form of scrofulous affection has been drawn broadly and strongly; they are not always, however, so clearly outlined; but so convinced am I by experience of the advantages of separating the two sorts, both in diagnosis and treatment, that it appears to me impossible to insist too strongly upon their varieties.

Local Treatment.—The first and most important part of the local treatment is rest. A time arrives, as we shall see, when it becomes a grave question whether entire immobility should or should not be continued; but there can be no doubt that at first the point should be kept perfectly still by bandaging a well padded splint upon the limb. The joint itself must be left uncovered by the bandage for the application of any remedy that may be desirable, which in this state of the disease belongs chiefly to the class counter-irritants and derivatives. The former are chiefly liniments of ammonia, camphor, turpentine, &c.; sinapisms, blisters, iodine, nitrate of silver, mineral acids, potassio-tartrate of antimony, croton oil. As a guide to a choice of these remedies, we may conveniently take the following considerations: That although the disease be chronic throughout, its inflammatory condition is more marked at the commencement; and this condition is at the same time as far as possible from the surface. Hence, in the early stage, our remedies should be sufficiently active really to attack the disease, and also should be such as are not apt to cause deep inflammation. Experience in the use of counter-irritants shows that we can produce considerable amount of superficial action with little deep-seated inflammation by means of a brisk application used but once or twice, while the repeated employment of a milder remedy induces a deep action, which may penetrate sufficiently to mingle with, and add to the disease. Hence we should rather use, at the beginning of the malady, nitrate of silver with nitric acid,[1] croton oil, or the tartar-emetic ointment. This last remedy is not, however, advisable in any but deep joints, since the inflammatory action round the pustules spreads to a very considerable depth.[2] Blisters are very useful in the early stage of the complaint; they should, at the hip or other deep joint, be applied as near as possible to the seat of the disease, but at the knee or other superficial part they should not be placed immediately over the synovial membrane. The blister should be allowed to heal at once, and another opened at a convenient spot, thus producing the greatest amount of irritation with as little injury to the skin and as little penetration of the action to deeper parts as possible. These applications, freely used and combined of course with general treatment, may be sufficient in cases which are mild and marked by little inflammatory action or evidence of much scrofulous cachexia; but they can rarely cure the disease, and to trifle with the first appearance of such a malady is improper; if the milder remedies do not quickly benefit, it should be attacked at once with means capable of changing the diseased action. These may be enumerated as issues, moxas, and the actual cautery. Issues of caustic, or moxas made with fire, may either of them be employed. The issues should not be large: about the size of a sixpence, or at most a shilling, is in my experience sufficient. The slough separates in from five days to a week, and then a glass bead should be placed in the wound: one is sufficient to keep it open, and to crowd it with them is useless and painful. An issue should never be allowed to remain open long; when this is permitted, it loses all counter-irritant power, and simply acts as a seton by keeping up a discharge, which weakens the vessels of the part. From ten to three weeks generally changes the wound from an irritable to an indolent sore, known by its thick, pale, everted edges, and flabby granulations. As soon as the issue has put on this appearance, it should be healed and another opened in some other parts near the joint. It is well to be cautious in selecting the spot where the caustic is to be applied, for in superficial joints it may happen that an issue in a badly chosen seat will actually penetrate the joint and set up an uncontrollable destructive inflammation. In the Museum of the College of Surgeons (Pathological Series, No. 898) is a specimen of a knee-joint, in which this accident had occurred. Of moxas but few examples have come under my notice, and from what I have seen of them I am not inclined to recommend their use, although they certainly possess some advantages over caustic issues. The first is, that if chloroform be given during the actual application of the fire, they are less painful: I have frequently seen patients suffering severe pain for hours after the caustic application, while the pain from the burn diminishes very rapidly and soon nearly ceases. The second advantage is that the sore produced remains much longer irritable, and it is not therefore necessary to renew the application so often. But it is to be observed that the action of the fire penetrates deeply; it is only suitable, if ever, in the late stages of this disease, and is more adapted to a malady commencing in the bones; to caries, for instance, of the vertebræ. All these applications, although if properly used in proper cases they may produce benefit, are open to very serious objections. The frequent application of blisters or highly stimulating embrocations relaxes and otherwise injures the skin, producing therein a chronic state of congestion, a passive hyperæmia, and thickening, which is very similar to the diseased condition they are intended to combat, but which they frequently aggravate. Issues, and in a rather less degree moxas, are liable to inflict similar injury. It has frequently occurred to me to see persons suffering from a diseased joint with an old large issue in its neighborhood, whose condition, both locally and constitutionally, has been greatly improved by allowing the sore to heal. It is essential, as we have seen, if issues are to produce benefit, that they should be frequently renewed. This subjects the patient to a great deal of pain: and moreover it destroys a large part of the skin and fills the subcutaneous tissue with spots of soft, vascular, ill-formed scars. The practice also of constantly keeping a poultice over these sores is to be greatly deprecated, since nothing tends more to aid luxuriance of fungous granulations than the application of warm moisture.

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[1] Formula—Argenti nitratis ʒss.
Acid. nit. fort. ♏ij.
Aquæ destillat. ℥j.

[2] A paper appeared in the Glasgow Med. Journal, by Dr. Klingner, vaunting highly the use of veratria in this disease. It appears to me that the friction has as much as the veratria to do with the cure in the cases he quotes.

Formula—Veratriæ gr. v.
Sp. vini rect. ʒj.
Axunge ℥j. Ft. ung.

Another method of producing a sore, however, is very different in these respects, namely, the actual cautery. This treatment was in great repute in the earliest era of surgery and down to the latter part of the Middle Ages; but of late years it has fallen into undeserved neglect, although it has had its zealous supporters. Probably the chief reason of its disuse is the pain which it caused, and the terror with which the application of heated iron to the skin might well inspire any patient. Without chloroform I should hardly have courage to recommend such a remedy; but with the anæsthetic its application, like that of the moxa, is less painful than caustic potash. In fact the remission, in some cases the utter disappearance, of the painful symptoms after actual cauterization renders it a merciful and not a cruel remedy. Rust, of Vienna, relates a case of a young gentleman suffering severely from hip-disease, whose parents could only induce him to undergo the operation by promising to take him to the theatre that evening. The application was freely made, and the boy's pains were so much diminished thereby, and he was so cheerful, that he insisted on the performance of the promise and greatly enjoyed the theatrical entertainment.[1] Such cases of very rapid action will rarely be met with, but experience in the use of the remedy will be able to show its immense advantage over all other applications in properly chosen cases.[2] The stage of strumous synovitis to which it is more particularly adapted is that in which the first symptoms of inflammation have somewhat subsided, but in which some such action continues and enlargement is still going on. In such cases the cauterization may be used to produce benefit in three ways—firstly, by the actual counter-irritation of the burn on the skin; secondly, by the establishment of a slowly-healing irritable sore; thirdly, by the pressure on the subjacent parts of the skin strongly contracting during the healing process. In the first two effects, the shape of the cauterized surface is evidently immaterial; but in order to obtain as much benefit as possible from the last effect, the skin should be charred in lines parallel to the axis of the limb. This mode of applying the iron was called, by Percy, Cauterization Transcurrente,[1] because he found that Celsus had described such a method in malignant ulcers of the lip "*necessarium est tenui ferramento adurere, quod quasi transcurrere non imprimi debet.*" The shape of the iron is a point on which much professional dandyism has been wasted; the more so as its form is absolutely unimportant as long as it has sufficient bulk to retain its heat for some considerable time, without being clumsy, and has an angle or some other part small enough to mark lines sufficiently narrow. Rust's iron seems to me to answer this purpose as well as any: it is a three-sided prism with the corners blunted and mounted by one of its oblong sides on a bent handle. An oval cylinder mounted in a similar way is also a good shape, as its thinner or its broader side may be used; or again the end, if it be thought desirable (as in some cases) to produce an issue.

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[1] "Arthrokakologie, oder über Verrenkungen durch innere Bedingungen," s. 159.

[2] Mr. Syme, in his "Principles of Surgery," when speaking of Ulceration of Cartilages, p. 223, says, "Caustic moxa and the actual cautery may all be employed for the purpose (production of an issue); but the last mentioned agent is infinitely preferable to the others. It is often thought that the pain which attends the opening of an issue affords the benefit that is derived from it, and that therefore the moxa, which usually produces a superficial effect, should be selected; but it has been well ascertained that any considerable amendment can in general be hardly perceived, until the discharge of the new secreting surface has been fairly established. The ulcers of burnt surfaces are always very slow healing, and hence there is an obvious advantage of the cautery over caustic; but its chief recommendation is experience, and that is so strong as to leave no room for doubt or hesitation in preferring it to the other means."

There are different modes of performing even this form of operation, which I would venture to name in English, linear cauterization. Percy, and following him Bonnet, advises that the lines should be at first very lightly drawn, and the iron passed over them again, and this is the mode which farriers chiefly employ. Rust, on the other hand, deprecates any reiterated passage of the cautery over the skin, recommending a slow marking of the lines once with gentle pressure. The fact is that both are useful in different cases, for in the former mode the heat penetrates more deeply than in the latter, and is therefore to be employed in well-covered joints, while the superficial ones should be cauterized in once. All surgical writers on the subject, as well as all experience, show the disadvantages attendant on dividing the skin with the cautery;

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[1] He describes three methods of using the cautery, "Cauterization transcurrente" —"inherente" for the formation of issues— and "objective," in which the iron is only approached to the surface without touching it: a useless method.—Pyrotechnie Chirurgicale, 1811, p. 84.

that is to say, the iron itself must not penetrate to the subcutaneous tissues, but the heat should destroy the whole thickness of the cutis. The iron is to be *white hot;* even Percy, Rust, and Bonnet, who operated without chloroform, found that much less pain is produced by a very hot iron than by one only red hot; hence two, which may be changed as they cool, are to be used. The lines, in the case of the knee, should be an eighth or a sixth of an inch broad, and from three to four inches long, or even more if the joint be voluminous; they should be at least an inch apart. At the knee, for instance, one should be placed on each side of the patella, and one just in front of the inner and outer flexor tendons. These are generally sufficient. Immediately after the application the skin becomes of a dark golden hue, studded with little drops of a clear watery liquid. A piece of dry lint may be placed over the part. The whole operation is easily completed in from two to three minutes, and, if the iron have been hot enough, the patient on recovering sensibility is astonished to find that he does not suffer from the burn; but if the iron have not been sufficiently heated actually to destroy the skin, pain will remain. Often when the starting of the limb and other sufferings have been severe, the cautery relieves them like a charm, and the patient may pass a better night than for weeks previously. No application to the part is necessary; a piece of dry lint over the joint prevents the patient examining it with too great curiosity; a rosy flush, which after the operation pervades the untouched skin, soon disappears; in two or three days, however, it returns, and the charred cutis begins about the fifth or seventh day to separate at the edges. Poultices and warm fomentations are to be avoided: cold water or simple ointments are the best dressing. If the irritation and pain have disappeared on the use of this application, we may feel assured that the active congestion and the spread of the disease has been arrested; the tenderness even on the localities of its choice will vanish, and our next care is, to insure the continuance of this change, and to produce absorption, or, if not, consolidation, and further development of the unhealthy tissue. The sores produced by the cautery should be allowed to heal as quickly as they will; in doing so they will contract and produce a highly beneficial pressure on the soft parts beneath, and this it is our duty to aid by firm bandaging, at first, while the discharge is considerable, with a simple roller; afterwards by means of tightly-applied strapping plaster, previously protecting the wounds with some simple dressing. Pressure of this sort was first recommended by Dr. Scott, of Bromley, but in these strumous cases the mercurial dressings which he also advocated are, in my opinion, injurious. Even and tight strapping over the whole joint, so as to produce considerable pressure, is the real remedial agent.

At the same time, it is not advisable to keep the patient in bed, but to allow some movement, which is easy, when the disease is in an upper extremity; even when it is in the lower, carriage exercise in the open air should, if possible, be procured. By these means we shall check the tendency to produce fresh granulation: our next attempt is to get those already formed either organized or absorbed.

Hitherto we have spoken only of cases which, having seen them from the first, we have been able to manage in our own way; but this does not always happen, and we may only be called upon after the patient has suffered for some considerable time; has been kept in bed with perhaps an issue that has been open for six weeks or two months, or possibly with no treatment at all. The joint will probably be found shapeless, swollen, pulpy; perhaps it may be painful; probably, particularly if the knee be in question, it will be a good deal flexed. Now, we shall in nearly all such cases find on examination, unless the disease have gone too far, that the whole joint may be manipulated without producing pain; that pressure upon the choice seat of tenderness will cause no expression of suffering, and that no startings or any acute pains disturb the patient's sleep. Even in such a case as this we may in all likelihood cure the patient by first applying strong pressure, manipulations, rubbing, and passive movement. The condition into which the new tissue has fallen is simply a passive one; the material exists, but there is no action in it; perhaps there may have been an abscess which has left a sinus, but the suppuration is very sluggish; the rest of the tissue is doing nothing.

Now, if the granulations be allowed to remain in this passivity, they may, after some years, contract and consolidate even *in spite* of such treatment; but their more general course is to take on a retrograde action, gradually to yield to suppuration, and to involve the textures of the joint which they inclose. Our object should be, taking advantage of the passive state to produce absorption of the jelly-like tissue. The painless condition upon pressure, and particularly of that spot which is the chosen seat of tenderness, is the proof that we may employ not merely pressure, shampooing, and rubbing, but passive motion; and we can in a great number of instances, even after abscesses have formed, produce absorption of a large portion of the false tissue and consolidation of the rest. I desire to lay powerful stress upon this point of enforcing passive motion as soon as actual inflammation is checked, and mere vegetative cell-growth is the only action going on. M. Bonnet, the first writer who attempted to show the value of such means, has not limited its use sufficiently to the cases of which we are now treating. The counter-indications to this treatment are an active condition of the swelling evidenced by pain and tenderness, any considerable amount of degeneration or suppuration, starting pains, and tenderness of the joint surfaces.

It may be that when the patient is first seen the limb will be in some unnatural position, which must be changed; it is almost superfluous to insist upon the necessity of placing an anchylosing joint in that posture wherein it will be most useful to the patient; and it is not now intended to speak of posture in anchylosis, but of position as an actual remedy for, or preventive of, further disease. When the limb is in a state which does not permit the employment of either passive motion or shampooing; when, therefore, an active condition is still present, and we would by choice not move the limb, unless necessary, even in this condition we are to overcome any malposture, and put the joint into that attitude most fit for the reduction of inflammation. This posture is in every instance such as will prevent any unequal amount of traction or of pressure on either soft or hard parts of the limb. For the shoulder joint, the elbow should be a little in front of and separated from the side by a thick pad. A diseased elbow should be bent at about a right angle; the wrist straight; the knee must be not far from a straight position; the foot, for ankle-joint disease, at right angles to the leg. If, when we first see the patient, we find that the direction of his limb deviates much from those above given, we are to place it in a proper position. For particulars concerning the means of doing this we must refer to Chapters XI. and XVII. It must suffice here to say that the replacement may be either sudden or gradual; and may either be aided by subcutaneous division of opposing structures or without such aid. In by far the greater number of instances in which inflammation still lasts, gradual straightening, by the means of my extending splint (see Chapter XI.), is the best method; more particularly if there be tenderness on pressing the joint surfaces together: also, in this condition of parts and mode of proceeding, it is less frequently desirable to cut the tendons, unless the patient be a child. On the other hand, if there be no tenderness either of the joint surface of the bones, or that chosen seat already so often mentioned, the replacement may be done suddenly, and, if much change have to be made, under chloroform. Here, however, the tendons are to be divided, particularly in the case of children, since their muscles are much more irritable under elongation than those of adults.

Another condition of the malady must now be considered. It often happens that patients first present themselves to our notice when all the structures of the joint—synovial membrane, cartilage, in part the ligaments and the spongy ends of the bones—have been converted into soft gelatinous granulation tissue, through which sinuses run, discharging pus. In such cases anchylosis is the best that can be hoped for. To produce this result, we must bring about solidification and further organization; therefore, some action of this soft tissue. It will not always continue, though it may do so for a long time, in the soft gelatinous state; if it do not solidify, it will soften, *i. e.*, degenerate and suppurate. We may use the cautery if necessary, and pressure, but not movement of the joint. Passivity of the tissue, without any means of calling forth action, is fatal to our hopes of this sort of cure, if cure it may be called. Keeping the patient confined to bed and one room, with a sluggish discharging sore, is the best means of weakening the constitution and producing that degeneration and suppuration which we dread. Open air, and as much exercise as can be managed without moving the joint, are the best means of keeping the health sound and the tissues in good condition.

That most distressing symptom, starting of the limb, is, as we have seen, an accompaniment of this part of the disease; that is to say, of the bone inflammation. For an account of its management, &c., the reader must refer to the chapter on Articular Osteitis (Chapter XI.—*Treatment*). These pains are very often one great cause of the sudden loss of health, which at this time often supervenes, and of the uncontrollable suppuration that then takes place in the tissues. The case of Hogan (Case XXXV.) shows this point, and it also shows how, in this form of disease, pressure may annihilate those pains even in a malady so far advanced that we can expect from it no other benefit.

If the treatment be succeeding the joint will begin to diminish in size, and, what will more quickly attract the eye, it will lose its baggy shapeless appearance; at the same time it becomes harder, more elastic, the discharge ceases, and the mouths of the sinuses close. At this time we have to reconsider the position in which the limb is placed, and to assure ourselves that it is in that posture which, if it become fixed, will be most convenient to the patient. Such will, of course, be the case if the rules already laid down have been attended to; but it may happen, that owing to some cause, a little change will be desirable. Soon comes another point for consideration. When the membranous anchylosis is pretty firm, the bony may shortly supersede it; it becomes a fair question whether or no we shall take any means to prevent this, or whether we can succeed in doing so; and my conviction, drawn from the number of cases which it has been my lot either to watch or to treat, is that as soon as the sinuses have soundly healed, it is safe, possible, and advantageous to prevent the occurrence of true anchylosis by a judicious application of passive motion. One exception may exist to this otherwise general law—when the disorganizing processes about a knee-joint have been extensive, and have caused luxation to such an extent that we are justified in despairing of obtaining sufficient strength in the limb, save by bony union. Such cases are, however, extremely rare.

It occasionally occurs that no treatment will check the spread of the suppuration, or the case may only present itself to our notice when the malady is already advanced, and the patient's health broken; when abscesses have formed among the deep muscles in the neighborhood. In such unfavorable circumstances the surgeon's thoughts at once revert to his knife and his saw, and very frequently these are the only means of saving life. The operations to be chosen and the reason of their choice are the subject of a special chapter; at present we are only occupied in considering how the surgeon shall save a joint, and not how the patient shall lose it. The experience which I have had of the fungous form of strumous disease, and the efficacy of well adapted treatment, convinces me that extensive suppuration and utter loss of health are the only reasons which should cause us to remove the part. The mere presence of sluggish granulations, evidenced by intractable and long persistent tumefaction, is no valid cause for such an operation. All such tissue may be made to consolidate or to be absorbed by the adoption of fitting means.

Cases of this Disease.

Case XXVIII.—George Caverner or Kavanagh, aged 5, a thin, pale child, with reddish hair, a tumid upper lip, and red-bordered eyelids, came to me at the Charing-Cross Hospital 6th October, 1859, with a swelling at the ankle-joint. The boy was in no pain and could walk well, but the mother observed the swelling six days ago; the boy knew nothing about it. He had also a slight strumous ophthalmia of the left eye.

The ankle is swollen; the tumefaction is chiefly visible behind and in front of each malleolus; it extends also, in a smaller degree, as an ill-defined band across the front of the joint. It is slightly tender, chiefly in front of internal malleolus.

A splint on the inside of the ankle; two bandages to be used in fastening it, that the limb just above the joint be left uncovered; to this part, *i. e.*, lower end of tibia, a narrow blister to extend from one malleolus to the other; five grains of calomel and rhubarb to-night in treacle.

11th. The blister rose pretty well; the boy's eye looks better. Ordered the following draught three times a-day after food:—

℞. Potassii iodidi gr. ij.
Ferri iodidi gr. ij.
Aquæ ℥ss. M.

13th. The boy's eye better, but the ankle much the same; the blister is healed; splint to be fastened on with strapping-plaster; blister across instep just below the joint.

20th. He does not get on as quickly as I should like. The eye is more inflamed again. Repeat the calomel and jalap as before, and after its due action let the following be taken in the form of pill night and morning:—

R. Hydrargyri c. cretâ gr. i.
Quinæ disulph. gr. ij.
Mist. acaciæ q. s. M.

27th. The eye nearly well; ankle not tender: the joint to be tightly strapped after Scott's method, with Empl. Resinæ; to discontinue the pill; repeat the iodide of potass and of iron as before.

From this time he progressed continuously to recovery; was discharged from attendance at the end of November.

Case XXIX.—Jane Sherman, aged 6, a pale strumous child, has been suffering for twenty months from pain and swelling of the left knee, and was admitted into the Charing-Cross Hospital, under my care (through the kindness of Mr. Hancock), December 9th, 1859. The knee is flexed at about a right angle; the joint a good deal swollen, round, and shapeless; the child cries when it is touched and when any attempt is made to move it; the flexors, of course, act against any attempt at straightening; the joint is white, not hot; the thigh and leg are shrivelled.

I drew four lines of linear cauterization, one on each side of the patella, and one an inch behind each of these, and got the limb into a straight position without dividing the tendons; for under the action of chloroform the contraction of the flexors was found to be voluntary or emotional, as was suspected. On recovering from the chloroform and the sleep that came on afterwards, the child expressed no sense of pain, but sat up and began to play with other children in the ward and with toys.

On the 3d day the skin between the cauterized lines looked red and inflamed; on the 5th some separation at the edge of the charred slough had occurred. The horny portion gradually separated, and on the

1st January, 1860, the marks left were simply clear lines of ulceration with small conical granulations; they were dressed with zinc ointment and gradually contracted.

30th. The knee was much diminished in size; all the scars of the ulceration are healed, except the one next the patella on the inner side; for some reason that I cannot fathom, this ulcer opened out wider than the others; it is, however, contracting, and discharges very little. I strapped the joint pretty tightly, bandaging the limb upwards from the foot.

Feb. 15th. The line of cauterization healed a week ago; the knee is much smaller; it is kept tightly strapped. The child is allowed to be up, and to move about by means of a stool and the sides of her bed.

March 6th. The child was nearly well, and her mother insisted on taking her out, though I should have wished to have kept her another week; passive motion had been used, and the joint promised to be nearly as useful as ever.

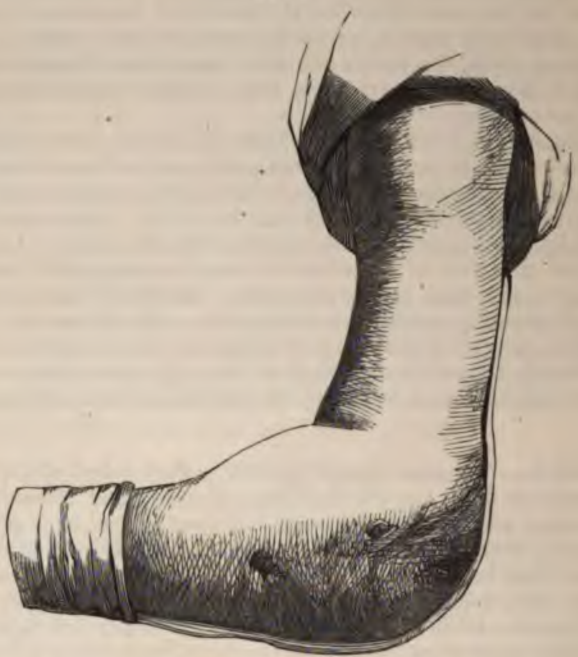
Case XXX.—Marianne Taylor, aged 12, a dark-haired girl with coarse features, came to me at the Charing-Cross Hospital 23d November, 1858, with a diseased elbow which, she says, has troubled her more or less since she was three years old. At that time she fell down and hurt her arm: her mother took her to St. George's Hospital. After about three weeks she seemed well; but, four months afterwards, the elbow began again to swell, and she was taken back to St. George's Hospital; then to some other places: matter came away, and a sore continued discharging till she thinks she was about five years old, and it was much longer before she could use the arm. She has had the present relapse for nearly two years; she is a boot-closer, and could do her work till six weeks ago; now she wears her arm in a sling.

The elbow is much swollen; the whole being a shapeless, conical mass, concealing all the shape of the bones, and without distinct boundary between the swelling and the rest of the limb; both upper and forearm are much wasted. The tumor is white, soft, pseudo-fluctuating, perhaps a little hot: the scars of old sinuses are to be seen below the situation of the outer and inner condyles; there is a very soft place near the latter which is likely to suppurate. She has no starting pains, no tenderness of the joint-surfaces; the arm may be flexed a little way, producing slight pain and no grating.

Ordered splint of gutta-percha to be fitted to the outer side, and a little in front of the arm, so as to leave the outer condyle bare; it was to be cut in a rectangular form, to extend from the axilla to the hand, allowing this to be in a position between supination and pronation; to take two tablespoonfuls of the mistura potassii iodidi composita three times a day.

27th. Mr. Short was good enough to administer chloroform, and I made two long lines of cauterization from two or three inches above the bend of the elbow to the same distance below, one a little behind the outer, one a little in front of the inner condyle, taking care to draw this latter over the softened portion of tissue above referred to. The iron, quite white-hot, was passed twice through each line.

Fig. 8.



Strumous synovitis of elbow.

30th. The girl had gone home when she recovered from the chloroform and was in no pain; to-day the elbow smarts a good deal; cold lotion.

5th Dec. Lines of ulceration begin to separate the eschar from the rest of the tissue; the skin has a bright rosy blush, but she says the pain is not much.

12th. The sloughs have disappeared. On the afternoon of the day she came to me, about a teaspoonful of pus flowed out of the middle of the inner eschar; it was in order to lay open this suppurating point that I drew the line over it, for by such means I hoped to procure the rapid filling up of the cavity; this has perfectly succeeded, the tissues in that part are as sound as elsewhere: the tumefaction has very much decreased. Dress the sores with strips of lint and nitric oxide ointment.

19th. The wounds begin to contract and the swelling is still decreasing; the compression from skin contraction is evident; the ointment continued, and before putting on the splint a bandage was applied tightly and smoothly.

26th. The wounds healing; there is now little enough discharge to allow the application of strapping.

Jan. 10th, 1860. The strapping has been kept applied and the arm is much diminished. Continue.

24th. The elbow about the same size, on measurement, as the other, though it looks bigger on account of wasting of the limb; no pain on pressure anywhere; more particularly no tenderness between outer condyle and head of radius. Passive motion carefully employed for about ten minutes, and the arm replaced on the splint; the biceps somewhat contracted.

30th. The arm was subjected to passive motion every other day, and the splint retained for ten days after the above date; since the 20th a bandage simply has been applied and the arm kept in a sling. She has now very tolerable movement of the arm. Bandage to be discontinued; the elbow to be held under the stream of a tap every morning; throat a little sore. Since she has been attending, the complexion is much improved; to discontinue the compound iodide mixture, and to take instead an equal quantity of quinine mixture three times a day.

This patient went on very well; she came backward and forward occasionally, rather to procure a repetition of her medicine than for the sake of anything being done to the arm. She had in March no other appearance of disease than the scars of the cautery in thin red lines, a little thickening, detectible by touch, about the joint, and inability to get the arm perfectly straight.

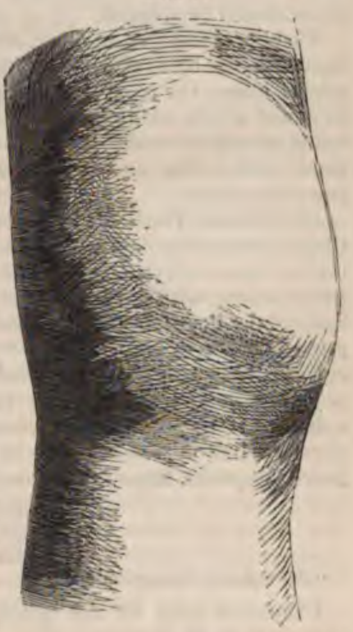
Case XXXI.—Catherine Dogget, aged 18, strong, stout, came to me at the Charing-Cross Hospital 9th May, 1858, with diseased knee.

The swelling first came on, with some slight pain, eight months ago; she was in the country at the time and was able to rest; she did not put the foot to the ground for a month; the pain went off, but the swelling did not altogether disappear. She attributed the disease to a slight sprain.

The knee was, when I saw it, a good deal swollen; the swelling is soft and gelatinous, with false sense of fluctuation, round, concealing the shape of bone, &c.: she has some pain in it, and a spot on the inner side of the patella is painful and tender. A gutta-percha splint to the outside of knee; a blister to the inner side and above it; to be followed in three days by another below the joint.

23d. The knee is not better: the pain at the inner condyle is, if anything, increased. Chloroform administered; actual cautery applied in two lines on each side of the joint.

Fig. 9.



Strumous synovitis of knee. (Early stage.)

23d June. The cautery lines all but healed; for the last week the bandage has been very tightly applied and she finds relief; the joint was strapped.

30th July. The joint is still strapped: it is now very nearly the same size as the other, though most anatomical points, as the ligamentum patellæ, and the depressions on both sides, are not marked as they should normally be. Ordered rubbing night and morning with flour or other inert powder.

August. This patient perfectly recovered.

Case XXXII.—I was asked by Mrs. T. to see her daughter, aged 17, 30th September, 1859, with a diseased knee of four years' standing. She has dark long hair; a white transparent skin; very white conjunctivæ, long dark lashes. Her health is a good deal broken by long confinement.

At school, rather more than four years ago, her knee became painful; she may have hurt it, as she was very fond of running and other exercise, but does not remember it. When the knee became painful, it swelled. She remained at school about three weeks, and then was sent home. A pasteboard splint was applied to the leg and the joint was blistered; had two issues, one after another, and the knee got so much better that she could return to school, but had always to wear the splint; could walk with a stick, and after a time without. Eight months ago she fell down two or three steps and hurt her knee very much; it swelled again, slowly, and an abscess burst at the inner side just below the head of the tibia; a little after that she had starting pains at night, and a week or so later these occurred also in the daytime, and they do so now. She desires nothing so much as that these should be stopped.

There is a rounded swelling, without definition of edge, at the knee; the mouth of the sinus still open; marks of issues, one on inside, one on outside of knee; the joint is tender and she has starting pains; the joint can be flexed a little without causing any severe pain or producing any grating, but it cannot be straightened; it is in very fair position, but is rather too much bent. Her mother has taken up residence in town, having come from ——shire.

3d October. The long continued starting pains, showing that the cartilages are undergoing ulceration, would not allow us to hope a restoration beyond false anchylosis: the first object is to stop these pains; divided the flexor tendon with long tenotomy-knife, and fastened a Liston's splint at back of the limb with well-padded straps and bandage; to have at bedtime a glass of sherry with fifteen drops of laudanum. Slept better; had one or two little starts towards morning.

7th. Has had less starting pains since the first night; has taken no opium since then, but has continued the sherry; thinks it produces acidity; does not like wine. Ordered to take two tablespoonfuls of the Mistura Ferri composita three times a day, and the following draught at bedtime:—

℞. Chloroform ♏iij.
Træ. aurantii ʒiij.
Aquæ flor. aurantii ℥j. M.

Cold water to be applied.

I took the limb off the splint, and by manipulations got it straighter and put it on the splint again.

12th. Every other day the screw has been turned half round; the joint is nearly straight enough; strapped the knee, leaving the mouth of the sinus uncovered; to continue turning the screw in the same way.

19th. A letter informed me on the 17th that the lady thought her daughter's knee was as nearly straight as I had desired it to be made, and there was a little pain in it; I happened not to be able to go till to-day; the pain was at the back of the joint, and has nearly gone off; the strapping had quite driven away the slight recurrence of starting. Ordered a leather splint for the outside and inside of the limb; strapped the knee still more tightly; to leave off the night draught.

28th. The splints have been applied and the knee feels very comfortable; she may now get up and move about on crutches.

7th Nov. Has been going on much the same; the swelling is now very much reduced and is harder; there is still a slight amount of tenderness, particularly over the inner condyle of femur: to continue in the same manner. The mouth of the sinus nearly closed; hardly discharges; put in a shred of lint to prevent too early healing.

11th. Was sent for; the discharge from the sinus has increased, and the startings have returned as bad as before; proposed the cautery and agreed to go next day and use it.

12th. Chloroform administered; two lines of cautery four inches long, one on each side of joint; Liston's splint again; repeat night draught.

19th. Had hardly any pain on recovering from the chloroform; the startings entirely ceased when I saw her the day after. The eschars separating; to dress the lines with zinc dressing, tightly bandaged.

Ordered to take of cod-liver oil one teaspoonful with the following draught three times a day:—

℞. Quinæ disulph. gr. ij.
Ferri sulphatis gr. ij.
Acidi sulph. dil. ♏vj.
Træ. aurantii ʒij.
Aquæ destillatæ ℥j. M.

29th. The starting pains have not recurred; the lines of ulcer from the caustic are beginning to contract; the granulations are small and pointed.

12th Dec. The caustic lines very nearly healed; joint strapped and leather splints reapplied. As it was probable that want of care, in bearing too much weight on the limb, caused the last relapse, I have not allowed her yet to get off a sofa-bed which she uses.

22d. This day have permitted her to get up and go about with crutches, but she is to use a stirrup for the foot, fastened to the waist by a band of the proper length to keep the foot from the ground; there is now hardly any, if any, tenderness over the inner condyle; the sinus has healed.

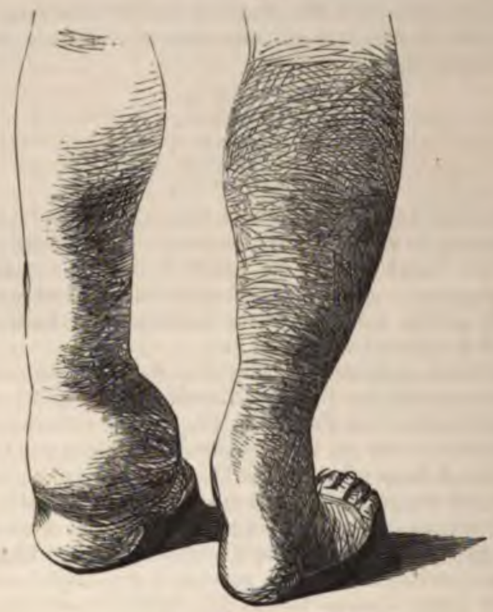
31st Jan. 1860. I have seen this patient once or twice; her health is much improved and she has gained flesh; there is, absolutely, no tenderness, and the joint is as nearly as possible the same size as the other; the patella can just be moved, laterally, by grasping it in the fingers, without pain; a slight crepitation, not bony; produced very slight passive motion in joint without pain; showed her mother how to move the joint, and directed her to do it, so as not to cause pain, every morning; the strapping, also, is discontinued, and the joint is to be shampooed, rubbed with oil, and bathed with hot water; the splint to be reapplied after these manœuvres; to leave off the stirrup.

3d March. Have seen this patient three times; the limb has more mobility and is not tender; she puts the toes to the ground in walking, and bears a little weight on them; the joint is anchylosed (false anchylosis); passive motion to be used with a little more energy.

This young lady is now able to bend the limb and straighten it again voluntarily, to a fair degree; she walks with a stick or umbrella by means of a high-heeled shoe; more might be done towards getting a flexible joint, but she is rather unwilling to have any further attempt, at all events for the present.

CASE XXXIII.—John ——, ætat. 7, a light haired, pale, strumous boy, was brought to me by Mr. Watkins, jun., of Chandos Street, 2d April, 1860, with a strumous inflammation of the ankle-joint. This complaint was of three years' duration, and appears to have been brought on by an injury inflicted by a large, heavy woman, in thick boots, having stepped back upon the child's foot; at all events, he has not been able to walk since that accident, and the ankle has been gradually swelling more and more. The difficulty of diagnosis is increased by some amount of malformation, so that the sound joint even looks a little distorted; the internal malleolus is very large, and the tibia, from a little above the joint, slopes outwards and becomes very small; the axis of the leg is thus directed inwards, and that of the foot outwards.

Fig. 10.



Strumous synovitis of ankle.

The diseased ankle, however, is very much enlarged, as may be seen by an examination of plate; the tumor is soft and pulpy and extends in a smooth even manner around the whole joint; is most marked at the back, but nevertheless is very considerable under and around the malleoli, also, in front, concealing the markings of the extensor tendons; the rest of the foot is thin, and the limb above the affected joint is wasted, showing in strong relief the puffy, ill-conditioned enlargement, at the back of which there is a red, inflamed spot where matter has formed. The difficulty of diagnosis referred to consists in the deformity and large size of the internal malleolus, which much militates against any certain judgment as to whether or not the bone is affected. Finding, however, that moderate pressure on the bone produces no pain, and that although misshapen, it is as near as can be judged of the same shape as the other, I am pretty confident that the bone is free of disease.

2d. A puncture was made where the skin over the suppurated part seemed thinnest, *i. e.*, over the Achilles tendon; a bandage was then applied, strongly compressing the tumor, but leaving the wound uncovered, and he was ordered to take a drachm of cod-liver oil, with iodide of iron, thrice in the day.

6th. I saw the child again, and Mr. Watkins agreed with my idea that, the disease being a strumous inflammation in the sluggish stage, pressure fairly applied offered us the best chance of securing the absorption or fibrification of the morbid growth; therefore the foot and ankle were tightly and smoothly strapped, after Scott's method, with the resin plaster, leaving the open wound uncovered, and he was ordered to continue the cod-liver oil.

13th. The strapping having become loose it was removed; the swelling was considerably decreased.

25th May. Mr. Watkins has been attending to this patient since the last date, and has been carefully and skilfully carrying out the plan of treatment which had been laid down; the child's ankle was much reduced in size; there was no pain on pressing the tumor, nor the bone, nor on pressing the joint-surfaces together; the limb was again strapped; pads are now necessary under the malleoli.

9th June. Still going on well as far as the ankle is concerned; the tumefaction is reducing, and there is no pain; the cod-liver oil no longer agrees; it seems to diminish appetite; the weather is getting warm; he was ordered to try cold bathing in the morning, if he remained chilly after it to use it tepid at first; to take three grains of the ammonio-citrate of iron; the ankle was again strapped.

3d July. Has been under the care of Mr. Watkins; the same plan of treatment has been carried out, and with such success that the tumefaction has greatly decreased, indeed, the ankle is very nearly the same size as the other; he can bear pressure on the bottom of the foot as strongly as I can produce it with my hand, and this does not give him any pain; but I cannot persuade him to put any weight on it in walking. The cold bath has not been used; he looks pale and worn, but his appetite is very much better; the ankle was again strapped with pads under the malleoli; the cold bath was insisted on.

13th Aug. The boy was brought to me twice since the last date; the ankle is not at all painful; the wound at the back has healed, but the boy is so nervous that it is very difficult to make him put the heel properly to the ground, although I can press the foot upwards very firmly, forcing the articular surfaces together more strongly than his weight would do.

Shampooing and cold douche; motion passive and active.

I saw this patient on the 24th September; his leg was still thin and weak, prevented his walking without support, but the joint is perfectly sound and the limb gains strength every day.

CASE XXXIV. William King, aged 33, admitted into Charing-Cross Hospital, under the care of Mr. Hancock, May 3d, 1859. He had been and was suffering severely from diseased knee, and came into the house with the intention of having the limb amputated.

He had been a porter in the Borough-Market, but had of late taken to a sedentary occupation.

There is a good deal of swelling in the joint, evidently in part fluid, and in part solid; he complains of a "bursting, forcing pain," also of a "gnawing pain;" but his most bitter complaints are against a starting of the limb, which comes on at night just as he is dropping to sleep, and wakes him up in great dread. A sinus communicates with the interior of the joint; a probe passed into it comes across bare bone about the edge of the inner condyle of the femur. Man's health much broken, but no sign of any visceral disease.

14th May, 1859. Chloroform was administered; Mr. Hancock excised the knee.[1]

Examination of Disease.—The joint was greatly distended by thin pus, in which floated one or two shreds; this escaped during the operation; the whole inner surface of the synovial membrane was either covered by, or converted into, a pink, soft material, of a pasty consistence; it was very abundant in the subcrureal sac, it encroached upon the patellar, femoral and tibial articular surfaces; the subsynovial and periarticular tissues were quite gelatinous.

The bones sawn off; the cartilage was found ulcerated all round the articular surfaces; in this part the bone was laid bare, and even some of that tissue had disappeared, there being a larger angular interval between the tibia and femur than could be accounted for by the mere disappearance of cartilage and fibro-cartilage (for this latter was also absent); this interval was filled up by a soft gelatinous mass, growing, apparently, both from the bare femur and tibia, also from the synovial tissues; the crucial ligaments were converted, likewise, into a soft, pink tissue, through which a few glistening fibres ran; the cartilage was gone from the inner edge of the patella, and false membrane sprouted out of the bone left bare; the rest of these cartilages were milky-white in hue, very soft, and accepting the impress of the nail from the slightest pressure; bones, on being split, showed red blush inside the articular extremity, which got less as it receded from that part.

Microscopic Examination.—The soft new tissues showed the same confusion of cells and bare nuclei as have been already described, but a large number of these contained oil-globules; the number of free oil-globules was very striking; this was clearly proved by the addition of liquor of potassæ and sulphuric ether.

Cartilages.—Section showed the corpuscles to be large and the cells therein remarkably evident; the hyaline substance was, in parts, plainly striated. In order to get a part clear for the use of a Valentin's knife, the bone was sawn through again at one corner, leaving the cartilage; and on breaking this and separating the fragments, a thin, tough film was drawn from the free surface like a fine transparent membrane; placed under the microscope this showed some large cartilage cells more thinly scattered than usual, since there was a hyaline part which was finely mottled, granular and studded with oil-molecules. I found that I could, in all parts of this case, produce a similar membrane-like beard.

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[1] Further account of case under the head of Excision.

With a sharp Valentin's knife some very thin sections were made, one or two of which preserved the outer edge; there is here and there a mark of separation between this margin (0.02 of a line thick) and the rest of the cartilage; sometimes an actual separation, sometimes no line whatever, but in all parts continuity of structure and continuity of cell-alteration may be traced between one portion and the other; this outer portion would, in a short time, have been shed in fragments into the joint-cavity.

CASE XXXV.—Daniel Hogan, aged 30, a dark-complexioned man, rather above middle height, young-looking, a machineman at a printer's, came to me 20th March, 1860, with a bad elbow.

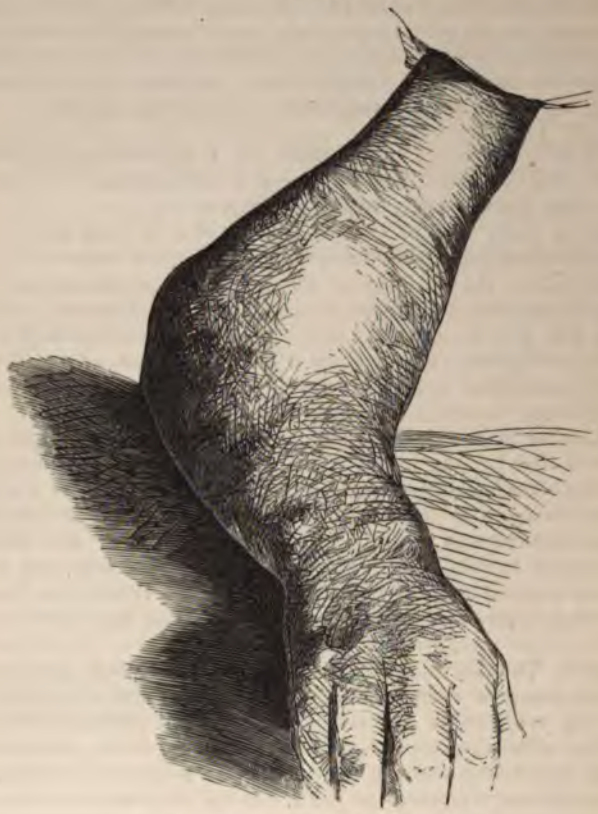
About fifteen years ago he twisted the left arm in some game; it was painful, and in a few days swelled; he went to King's College, they applied blisters and iodine, the swelling at the inner side increased and it was lanced; some pus flowed. Before the skin was well, however, he went to Mr. Verral, who put on a splint; and then to St. Bartholomew's under Mr. Skey, who leeched it, and in about a fortnight lanced an abscess which appeared at inner side of upper 3d of forearm. All this took place in about a year or eighteen months; motion of the arm was painful, but I cannot make out whether or not the inflammation was in the joint; at all events, he got so well that for the last fifteen years he has been machineman at a large printing office, having frequently to lift heavy weights, as a form full of type, and owing to a smash of the right hand, has used the left one most. Five months ago he had a swelling form at inner side, just below elbow, which got rapidly bigger, and in three weeks became very painful; he went to a medical man in the Waterloo-Bridge Road, who lanced it; the pain was a heavy and bursting pain. A month ago starting pains came on.

20th March. The elbow-joint is much swollen; the swelling conceals the shape of the bones, is rounded and shapeless; the arm above thin; the tumefaction is evidently in and around the joint; it presents a false sense of fluctuation, which is characteristic of strumous synovitis; the skin is red at inner side and below elbow, where there is an opening discharging pus; a probe passed into it entered the joint, but did not come in contact with bare bone; he cannot bear the slightest movement or pressure of articular surfaces together. A gutta percha splint was applied on the outside of the arm bent at more than a right angle; cod-liver oil and quinine administered internally.

12th April. Drawing made from elbow.

14th. There has been nothing of importance; the arm has increased in size, and the starting pains have become more marked; these pains prevent his sleeping at night; his looks have become worn and haggard; a part near the inner condyle fluctuates so distinctly that I puncture it; no pus escapes; I put my little finger in the wound, feel soft jelly tissue all round; a portion of this is extracted, examined beneath the microscope, nearly all the cells are found crowded with oil-globules; there are a great many free ones lying among the cells; to this formation is doubtless owing the fluctuation. It was explained to him that hardly the faintest hope existed of saving the joint, and he was advised to permit its removal; he wished to postpone this. With a view of trying to prevent the starting pain the joint was tightly strapped.

Fig. 11.



Strumous synovitis of elbow (advanced).

16th. He had, after being strapped, a couple of the starting pains, but has had none since; has slept very well. He tells me to-day, for the first time, that for about a month past, whenever he has leant in a certain way upon the elbow, he has had a peculiar sensation, as though one bone slipped or glided over the other out of place.

30th. He has continued to be free from the starting pains and his looks have very much improved; the elbow is reduced in size and harder, but the last few days he complains of pain over the outer condyle; an abscess very superficial, but of large extent, was found; the skin was discolored and evidently separated from the subjacent tissues for some distance; it was freely incised; bled smartly, to stop which pressure was applied.

2d May. The part of skin which was previously blue and discolored has ulcerated; the sore is oval, about an inch and a quarter long by three-quarters broad; the upper arm is swollen; strapping applied more tightly.

I learnt, in the earlier part of the case, that this man was able to live pretty well, having, it appeared, saved a little money, but it is now exhausted; he is evidently badly fed.

9th. The upper arm is swollen, with deep, hard tumefaction; again examined the limb carefully and passed a probe along sinus at inside arm; it struck bare bone, or rather seemed to pass into a chasm, with bare, rough, not crumbly bone, on every side. It was now pointed out to him that he had better make up his mind to the operation and come into the house for that purpose; to all this he agreed, but he could not be taken in; the following week the strapping was discontinued, but the starting pains recurred with so much violence that his health began to suffer, and it was reapplied.

22d. He came into the house, under my care, by the kind courtesy of Mr. Canton, and on the

26th. I excised the joint.[1]

Examination of Joint.—The synovial membrane was lined, and the sub-synovial tissues thickened by remarkably soft, yellowish jelly; on neither humerus, ulna, nor radius, was there the slightest trace of cartilage; the cancelli upon the first and last of these bones lay bare, except that a soft pulpy tissue seemed to grow out of them. The cancelli of the humerus were not bare, but a hole about the size of the bulb of an ordinary probe, in the centre of the surface, led to a cavity in the bone that was filled with pus.

The man has done extremely well.

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[1] For the rest of this case see Excision.

CHAPTER VI.

CHRONIC RHEUMATIC SYNOVITIS.

PATHOLOGY.

THIS disease is less common than the strumous malady; it seldom commences in a chronic form, but is usually the residue of an acute synovitis, either brought on by accident or by acute rheumatism. There is no doubt of the inflammatory nature of this disease. Pains were taken to show, at perhaps too great a length, that the joint affection in acute rheumatism is an inflammatory disease (see Chapter III.); because if the acute malady be not inflammation, still less can the chronic disease be of such a nature. But as it is proved that acute rheumatism really produces joint inflammation, so is it unnecessary to go further to show the nature of the chronic attack. Whatever may have been the origin of the primary acute disease, whether it have arisen from accident, exposure or rheumatic fever, it will, on subsidence, have left behind it much the same condition of parts. The synovial membrane and subsynovial tissues will be thickened and the cavity will contain an abnormal quantity of fluid. If the constitution be healthy, these relics of the malady should gradually disappear; but a constitutional evil is likely to prolong their existence. We have seen that after a slight injury a synovitis may arise, which, as it falls into a more and more chronic stage, may become endued with marked strumous characters; the diathesis prolonging the inflammation and impressing its own character of non-development upon the products.[1] In the same way, if the diathesis be rheumatic instead of strumous, an acute or subacute inflammation may be prolonged into chronic rheumatic synovitis, the products of the inflammation receiving the stamp of the constitution. The histories of the two forms of inflammation are, however, generally different because the strumous frequently begins as a chronic malady, running a tolerably even course from end to end. The rheumatic disease very rarely begins otherwise than after an acute attack; it is subject to frequent remissions and exacerbations; each of the former following rest and treatment, each relapse being generally preceded by some imprudence, over-exercise, or exposure to cold.

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[1] Let it, however, be remembered that strumous synovitis begins often as a chronic disease.

The first acute and each subsequent attack of inflammation consists, as all inflammations of connective tissues do consist,[1] of plentiful granulation, *i. e.*, growth of cells. In the rheumatic inflammations the tendency of this growth is always fibrinogenous—organizing; hence the inflammatory product, or thickening, instead of remaining in the soft gelatinous stage of fungoid granulation, becomes a tough, firm membrane. Thus the tissue never reaches a rank luxuriousness of growth, since most of the cells, instead of generating new cells, become transformed into fibres, and those fibres contract. The inner surface of the synovial membrane is therefore hard; presents long, rounded undulations, which run in a direction round the joint, and are separated often by rather deep but narrow fissures; the color of the tissue is of a light red-brown, about the hue of calf leather. The section is evidently fibrous, an appearance more easily visible when the tissue, which is tough, be torn, not cut. This material occupies the place of the synovial membrane, that fine fabric having disappeared in the much coarser substance, which is formed around it and on its surface. The growth may be of variable thickness in different cases, indeed in different parts of the same case. Thus at the knee it will be usually pretty well developed on each side of the ligamentum patellæ, will be thinner at the back, but in the subcrureal sac is formed into a dense, hard cushion, which not uncommonly almost fills up that space, and sometimes does so altogether.

If a thin section of the material be made, and it be placed, without much disturbance and no tearing, under the microscope, it will appear at first sight to consist entirely of cells, fusiform, oval, and round, very closely packed together; a more minute examination will show that the oval and round cells are, except on the surface or new parts, small in number, and that the tissue also contains a great number of fibres, which cross each other in every direction, and give a strongly striated and cross-barred look to the section, at the edge of which the fibres, projecting beyond the limits, are very visible. On examining, instead of a section, a shred, which has been torn in pieces with needles, the fibres appear more or less separate, and may be seen to be long cell-fibres, in many of which the nuclei are still perfectly distinct. The loose oval and the few round cells have almost disappeared in the tearing, and uncover certain torn portions of a homogeneous membrane, which evidently, in its uninjured state, permeated the whole tissue. How this membrane is formed from the cells, or whether it be formed from them, or only by them, it is extremely difficult to say; it seems to me that the round cells of the tissue have solidified this membrane out of the surrounding fluid into an intercellular substance, comparable to the hyaline material of all cellular structures. The new growth remains a very short time in the form of granulation, but becomes very quickly a fibrous membrane. When therefore the part has been for some time free of any inflammatory attack, the thickening material consists simply of fibres and elongated cells, like any other condensed areolar membrane. We seldom get an opportunity of examining the parts in this condition of lengthened quiescence: the patient will have died or the part will have been removed under an inflammatory attack; and under such conditions the cell-producing energy comes into play, so that we find newly-formed round cells even in the old and perfectly fibrated portions of the condensed and now reinflamed tissue.

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[1] See previous chapter, and my paper "On Granulation as it Affects the Joints," in Beale's Archives, November, 1859.

This tough product of inflammation grows much more slowly than the exuberant granulations of a strumous synovitis; its inner surface is smoother, and, as in the last-named disease, the cartilages are less covered; although from addition to its inner surface the synovial membrane will of course overlap them more than in a state of health.

In all cases the joint contains an increased quantity of fluid, either thin synovia or synovia rendered opalescent, or perhaps actually opaque, by admixture with pus. Much of the latter comes from the inner surface of the thickened membrane, *i. e.*, from the last layer of cells, but some of it emanates from the ulcers in the cartilage; the amount of its admixture has generally appeared to me proportionate to the amount of such ulcerations. I have never found abscesses in the thickened periarticular tissues, nor in the sheaths of tendons, nor among the deep muscles. When the tendinous sheaths are affected they are either distended with serous or synovia-like fluid or, in older cases and a more chronic stage, are thickened and partly filled with fibrous material. This peculiarity of the rheumatic inflammation not to suppurate is a mere corollary of the law, that such an inflammation tends to fibrinate—for the cell cannot fulfil two destinies, the formation of the fibres and that of pus; and as in these cases they are employed in the production of tough compact tissue they cannot at the same time generate the lowly organized and vegetative pus-cell.

The cartilages in their turn become inflamed, and exhibit in some parts a superabundant cell growth, beginning at the free surface and ending in ulceration through the thickness of the structure: the ulcers thus formed are generally clothed at the bottom and sides with fibres. In other parts, and sometimes close to such an ulcer, a surface of polished bone will be found on a level with the rest of the cartilage, and therefore of course projecting beyond the articular osseous surface. There is no doubt that this bone is formed from the cartilage (see Case XXXVI.). I have never found such ossification of articular cartilage except in rheumatic disease, and it is another instance of the organizing tendency of that form of inflammation. In other cases we find these structures lose their peculiar white opalescent or milky appearance, and become of a lightish-brown color, abnormally transparent, and at the same time very thin. This change is also due to an ossifying process, more evenly distributed; to one which, instead of being confined to a small spot here and there, is distributed over the whole articular surface of the bone, and causes a gradual encroachment of the osseous upon the cartilaginous structures. This mode of action is peculiar to the more chronic forms of the disease.

In more rapid cases, in which the ulceration of cartilage and the localized spots of ossification appear, it is not unfrequent to find parts of the cartilage with its articular lamella detached from the bone. In a case reported further on (Case XXXVI.) all these three conditions were present. In Case XXXVII. there were only the gradual thinning of the cartilage and some ulcers apparently old.

The bone is found nearly always condensed, *i. e.*, the walls of the cancelli thickened, and each cavity proportionally diminished in size, the whole therefore heavier. This is often strongly marked in the portion next the articular lamella, where the bone becomes almost solid. Besides this, the inflammation, as it spreads from the synovial, affects the fibrous tissues, viz. the periosteum, and others lying close to the bone; the inflammatory products which these throw out do not stop in the condition of granulations or new fibrous tissue, but actually advance to ossification, thus producing thickening; and, as much of the new material is in irregular masses, the so called osteophytes. Such growths are very rare indeed in strumous synovitis, and when they do occur, are quite small and unimportant. In strumous osteitis they represent mere roughnesses, overlapping carious depressions. In rheumatic synovitis they take a more important place, but still do not attain that stalactite form of exuberant growth which is seen in the so called rheumatic arthritis.

When the cartilages have become more or less destroyed or ossified the bones of the joint begin to grow together, and in this process again the organizing character of the disease is manifest. At the knee it is the patella which is first fixed to the outer condyle by a thick broad elevation, which appears to emanate from both the bones: the femur and tibia then become united also by broad new growths. When we look at a joint anchylosed by this form of synovitis we find that the junction is produced by considerable addition; generally the patella unites first to the outer condyle of the femur by a broad osseous process that seems to grow from both bones; then the femur and tibia become joined, also by processes, that arise from the two condyles of the former and articular surface of the latter; the inter-condyloid groove thus remains open and forms a foramen running through the middle of the conjoined bones. I believe this sort of junction to be assisted by adhesion to the bones and subsequent ossification of the interarticular cartilages, but it is not possible to assert positively that such is the case. The mode of bony anchylosis is very different to the strumous, in which the two bones seem to sink into one another, and to be so joined, instead of being glued together by a cement between them.

There is a peculiar look about bones in this state; the natural elevations and depressions become exaggerated, the surface here and there roughened by an osteophyte; the openings, whereby little arterial twigs find their way into the inside of the spongy tissue, and which are normally very small, become plainly visible holes and grooves. In fact, the bones, without being very perceptibly increased in size, are exaggerated; as it were, caricatured. On splitting a bone of this sort the spongy texture appears redder than natural, unless the disease be far advanced; some parts seem paler, more yellow, and on closer examination will be found harder; the external shell of the bone is thicker than normal; sometimes very considerably so. The condition of the part next the joint depends in great measure upon the more or less advanced form of the disease, upon the subacute and remittent, or upon the chronic, continuous, and gradual form of the malady. In some cases the cartilage and the articular lamella are here and there ulcerated through; the cavity of the ulcer is cut off from the rest of the articular facets by thickened osseous material: in other cases, and in other parts of the same case, a great portion of the deep surface of the cartilage is ossified; here the articular lamella has to a great degree lost its peculiarity of possessing no lacunæ with canaliculi; many of the black undeveloped bone cells have thrown out such prolongations, and the structure assumes more and more the ordinary characteristic of bone tissue; until, in the furthest advanced parts, those where the whole thickness of the articular cartilage is ossified, the structure becomes ordinary bone. If such an altered spot be, as sometimes happens, opposite a piece of the other bone still covered by cartilage, normal or ossified, and if motion of the joint be still allowed, its surface becomes polished and as smooth as glass; but if the spot be opposed to a part on the other bone similarly circumstanced, and no motion of the joint be permitted, the two grow together by the formation of new bone between them. It thus frequently happens that some part of a joint will be grown together by bone, while in other parts cartilage is still remaining, and fluid, purulent or otherwise, is between the two surfaces. The process is another instance of the organizing quality of this sort of inflammation. I have never found in any other form of synovitis the black cells of the articular lamella throwing out canaliculi.

Some of these cases, however, will not anchylose; but the cartilage having been ossified, the bone will polish, and the sufferer will use his limb. Such cases are rare, but yet sufficiently common to deserve notice. The considerable effusion which attended the commencement and the first few attacks of the disease will have produced such laxity of the ligaments, and perhaps other causes will aid in loosening the joint to such an extent that the altered articular surfaces slip occasionally from each other, setting the limb fast for a time. In two cases of this sort, reported at the end of the chapter, the patients were in the habit of tying a handkerchief tightly round the joint to keep the bones in their place.

SYMPTOMS.

This malady, as it arises from a more or less acute attack of synovitis, has always a certain and clearly-defined commencement, which may be either in some accident or in an attack of acute rheumatism. Its further history is one of improvements, followed by relapses; after a time the patient himself perceives that the exacerbations become more severe and longer. It may be that after the first acute attack the joint is so little injured that it can be used without inconvenience, except that in the morning it is "a little stiff at starting;" but each successive relapse adds to the swelling; the stiffness becomes pain even in the intervals, and at last there comes an attack from which he does not get well.

Each of the separate attacks will leave behind it additional thickening, and as each produces increased effusion of fluid, it follows that it will be attended with more pain on each occasion, *cæteris paribus,* than the last, since there will be more tension and more fulness. The symptoms of the first few attacks will be those of acute or subacute inflammation; but the subsequent ones will present the characters of old disease; the fluid will be less plainly felt, the thickening will be very evident: the shape of the distended sac, well marked in an ordinary acute synovitis, will be altered in a way soon to be described. On questioning such a patient, we shall learn that since the last relapse or two the joint has never been sound or well; that pain always came on at night in the warmth of bed; that from the affected part certain vague pains wandered about the diseased and other limbs.

The final attack, that which is never to leave the joint in a condition to be used, may not commence in a manner more severe than usual; but, as the mischief has reached a certain point, very little is required to spoil the whole mechanism. The shape of a joint in this condition is of a square angular character which is very remarkable; the outlines of the swelling tend to the straight and the edge of the tumefaction is clear and defined. The shape appears to me due to the contracting nature of the fibrous material which, being towards the centre, binds the subcutaneous tissues and the skin itself firmly to the bones. The tumefaction is hard, elastic, in most parts leathery, and unless the cavity be very full of fluid, there is no sense of fluctuation over the joint as a whole; and even in this contingency the fluid is felt to be separated from the finger by a dense tissue. The bursiform prolongations of the synovial sac are favorite seats for formation of fibrous tissue, and thus in the knee the subcrureal sac, in the elbow the pouch beneath the anconeus and triceps feel hard and lump-like, very much like additions to the lower part of the muscles, or like pads of India-rubber. In old cases the fluid will, in one or perhaps two places, approach nearer the surface, the wall having become thinner in this situation, and, in the same way as an abscess, it will point.

After a time, starting pains will be added to the other distresses, and these are more violent than I have ever found them in the strumous form of the malady. I have seen a poor fellow start up and seize the knee in a sort of fury, grind his teeth in agony, and break out in a clammy perspiration; but this case exhibited them in an unusually violent manner. The limb, already much thinner than the other, begins to waste very rapidly and remarkably; the muscles, particularly the flexors, get thin, while they remain contracted, feeling tight and sharp, like cords beneath the skin. Tenderness of the joint surfaces is not usual, and when it comes on lasts only a little time; on the other hand, bony grating is common, and often continues to the end of the case. The heat of the part is greater than the slowness of the inflammation would warrant us in expecting; it is not, of course, equal to that of acute rheumatism, but is more than in any other form of chronic synovitis and considerably above that of the fellow joint.

The redness is in the first few attacks well-marked, afterwards less so, probably on account of the greater thickness of parts; but in the continuous inflammation, which always comes on unless the malady be cured, the hue of the joint is deeper and of a warmer tint than the rest of the skin. The brownish hue which may have been imparted by the action of blisters is not, however, to be mistaken for a morbid symptom.

The joint is not unfrequently movable in an abnormal direction; the tibia may be pushed back, even from side to side, or the ulna may be moved laterally over the humerus. This is sometimes accompanied by very severe pain and violent spasmodic contraction of the muscles, setting the limb fast until the bones be replaced; sometimes, on the contrary, no pain is produced. The abnormal movements are always attended by a peculiar hard grating, harder but less rough than the crepitus of fracture.

The sheaths of tendons, as of the ham-strings, if the malady be situated in the knee, may generally be found, in advanced cases, thickened and enlarged, as well as hard from contraction of the contents.

It is worthy of notice, that as the constitution fails, in strumous cases, the lungs are extremely apt to suffer from a rather rapid form of tuberculosis. In rheumatic cases those organs incline to be affected with a peculiar dry form of bronchitis; there is expectoration, in the morning, of little hard lumps of mucus, more or less dark in color, and the bronchial sounds are harsh and whistling; the mucous membrane of the tubes is thickened. The heart, in one case that I saw, was slightly diseased; there was a rough sound on the systole; how long this had been present could not be determined, but it increased perceptibly as the case went on. Such an addition to the disease is, however, a concomitant, brought on by the rheumatic condition, and is not to be regarded as produced by the joint malady itself.

TREATMENT.

The diathesis upon which the continuance of this malady is founded has been the subject of much observation and speculation; we have in all probability arrived at a correct knowledge of its morbid poison, but its treatment nevertheless is scarcely satisfactory. This is not a matter for astonishment, for when it is considered that the source of the poison is the molecular change, which every particle of the body at some time undergoes (see Chapter III.), it is rather surprising that we can do so much.

In the whole medicinal treatment of the disease we find two separate conditions to be considered: the first, an inflammatory state, when the local malady is active; the second, a quiescent state when the synovitis has yielded, and the system is accumulating a fresh dose of the poison. I consider this separation of the two divisions as of extreme importance; for while the active stage lasts, our endeavors will and ought to be directed to checking the disease then going on; if, after the attack is over, the patient take himself away or be left to his own resources, a relapse is all but certain; but this very time of quiescence is that which should be seized upon as the period for treating the constitutional root of the disease, and for preventing a recurrence of the inflammatory condition.

Treatment during the Attack: General.—This particular form of synovitis is that which, of all others (except perhaps the syphilitic), benefits by the use of mercury pushed until it affects the gums with more or less rapidity according to the violence of the inflammation. The mode in which the medicine is to be given may be either by the mouth or by the skin of the inflamed joint: this latter method must be referred to again; it is necessary to remember that this resource will be cut off if the medicine be given internally so as to affect the gums. Mercury by the mouth is best given in the form of the bichloride or of either iodide: the first of these is that which I prefer; the last two are perhaps somewhat variable in preparation, and they injure by keeping, so that their strength is not so uniform as that of such a powerful remedy ought to be. One or two drachms of the liquor hydrargyri bichloridi thrice a day while the acute attack is going on, is the mode which appears to me best in these cases. The reason of my preference for this form of the drug is its solubility. In administering insoluble preparations of the medicine, we present it to the intestinal mucous membranes in a condition in which it cannot be absorbed, and we can by no possibility estimate what proportion of it may be altered and taken into the system, nor how much of it hangs about the folds and villi of the intestines. Our dose therefore is in reality uncertain, and when we cease giving the medicine, we must purge away what may have remained in the canal, or expect to see its action still going on. Occasionally, even after a free purge, some of the metal still appears to remain and to continue to be absorbed; at all events the spongy state of the gums continues to increase. With such a preparation as the bichloride, we know exactly what amount we give; when we cease to administer it the action also ceases; the same amount of effect is produced on the constitution by an infinitely smaller quantity of the mineral, and the debilitating effects are much less. Moreover, it may be added, that even in its immediate results, this salt appears to me to have more control over the rheumatic tendency than any other preparation of mercury.

Of iodine it will be necessary to speak more at length when the quiescent stage of the malady is considered; but it may be here observed, that the addition of from two to five grains of the iodide of potass to each dose of the bichloride is often of marked benefit, particularly after the mercury have been given some days by itself.[1]

Opium is a well known remedy for rheumatic disease, and ought never to be neglected in the active condition of this form of synovitis. It not merely allays pain, but I believe helps materially to check inflammation, particularly in the first commencement of that morbid act.[2] Given in the form of Dover's powder, it also promotes perspiration, a most desirable action in all rheumatic disease.

Colchicum is a remedy whose value is undoubted, but its influences for evil are almost as certain; it is more powerful in gout than in rheumatism (its effects will be more fully described in Chapter XII.). It has a power in checking the pains, &c. of both rheumatic and gouty disease, but it also has an effect in procuring relapses. Persons who have been treated with this remedy suffer from returns of the disease more rapidly than those treated by some other medicine. The relapses are, says Dr. Todd, apt to assume an asthenic character.

Antimony, in the form chiefly of James's powder, is also very valuable, and may be combined with the opium. When mercury by the mouth has been pushed as far as seems desirable, or when that medicine is not given by the mouth at all, the antimonial and opium together may be advantageously employed.

ACTIVE STAGE.—*Local Treatment* in the active or subacute phases of the malady, must be the same in most points with that already described in our second chapter. Blood-letting by means of leeches, or even the cupping-glass, may, if much febrile disturbance exist, be carried pretty far; but if the fever be inconsiderable, and more particularly if the patient be of a feeble habit, and if the attack be a second or third, no blood, or but a very little, should be taken. Heat by means of hot salt, or the old stone-fomentation,[3] or by india-rubber bags filled with hot water, is more to be commended in this than in the simple form of the disease. When the brunt of the attack has abated, the joint should be wrapped in mercurial ointment spread on lint, the whole to be covered with oil silk. Blisters may also be employed, but while any active inflammation is present these must not be put immediately over the synovial membrane.

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[1] There takes place a decomposition by elective affinity in this combination, and, in fact, the biniodide of mercury is given dissolved in the excess of the iodide of potassium. As a mercurial the combination is less powerful than the bichloride alone; but is active in that indefinable manner we call alterative. To be perfectly sure of its fresh and good condition the iodide of potassium should be added in powder to each dose just before it is taken. Light affects the biniodide of mercury.

[2] Refer to p. 71 for some account of the antiphlogistic power of opium.

[3] Chamomile flowers heated by putting them in spirits of wine and setting it on fire.

QUIESCENT STAGE. *General Treatment.*—The constitutional treatment during the quiescent form of the malady is more difficult, and requires nicer management. Let us again run over the patient's condition, that we may have a clear understanding of what we wish to effect. He has had one or two attacks of a subacute inflammation, whose symptoms have marked them as rheumatic, and these have left the joint tissues thickened; the part is therefore more or less stiff: it may otherwise be painless or may be the seat of nightly vague pains. Now, our aim is to produce absorption of this thickening, and so to modify the constitutional taint, that he shall not have returns of the active stages. Among the alterative remedies, the four following are chiefly available.

Mercury, and its use in the subacute condition, has been considered; a slower and more alterative mode of giving that medicine may be employed, if it have not been pushed or used at all in the more rapid stages; but here also the power of employing it locally must not be sacrificed by too zealous desire of administering it by the mouth.

Iodide of potass has already been mentioned; its control over inflammations of fibrous tissues renders it of undoubted value in rheumatic disease. It is more valuable in very chronic disturbances than in the more acute; indeed, when fever is present, it should be avoided, as it not unfrequently increases this action. There are few medicines of whose *modus operandi* we know less than we do of this, and perhaps every one who tries to think out the matter may have a different theory on the subject. My own idea is, that it gives a quality to the fluids of the body which tends to check cell generation; hence its very decided effect upon all connective and fibrous tissues—hence its capability of producing absorption and ultimate marasmus. This notion, however, is offered as a conjecture simply. A teacher at one of the large metropolitan schools once said to a student who asked about the action of this remedy, "Well, sir, it is difficult to define; but it is a very excellent medicine when you don't quite know what is the matter with your patient." To such a doctrine it is hardly necessary that we should subscribe, but it has this amount of truth, that the salt in medicinal doses does no harm which has yet been pointed out; although it may be that some one will by-and-by trace all the misfortunes of the world to this medicine—as has already been the fate of vaccination and salt. For rheumatic disease, the remedy may be advantageously given in sarsaparilla, or taraxacum, or the scoparium.

Alkalies, or other alkaline carbonates, in small quantities, are of very considerable value. A dose about an hour or two after each meal in some aromatic water, or in a state of effervescence, will have marked effect, not merely upon the distension and flatulence, which so often accompanies the chronic rheumatic state, but also upon the more distant symptoms. It may be permissible to call attention to the detrimental action of tea, and, to a less degree, of coffee; to the great injury often produced by ale or porter, particularly of those sorts that contain any considerable amount of saccharine; and the desirability even that the wines which may be substituted for malt liquors should be of that quality which is called dry, but which nevertheless contain as small a quantity as possible of acids—the tartaric and malic.

The other class of remedies, the diaphoretics, consists chiefly of opium with ipecacuanha, guaiacum, and James's powder; the former will be found useful when there is much pain at night, an irritative condition, with good performance of all secretions, except that of the skin; but chiefly may the Dover's powder be prescribed while the patient is taking some medicine of the alterative class.

Guaiacum is most availing in the atonic form of rheumatism, and therefore, from what has been said above, when the more acute stage has been treated with colchicum.

James's powder is most useful when actual feverishness, not mere irritation, comes on at night, and when the patient is strong and his appetite good.

A mid place between these two classes of remedies is held by certain natural springs, both for bathing and drinking—Buxton and Bath, for instance. Some of the continental baths, as those of Aix and Wiesbaden, have an advantage over ours, not merely in the quality of the water, but in the careful arrangements and adaptation to each case, in the mode of bathing, drinking, &c.

I do not, however, imagine that the particular locality, metallic, or earthy solution, is a necessary part of these bathing arrangements, although there is no doubt that change of scene and air, regular habits, &c., conduce to the cure. The various forms of bath, such as may be obtained in any good establishment, are extremely beneficial. The Turkish, hot air, and vapor, are valuable, and in cases where either expense or moving is to be avoided, the lamp bath, which is very easily arranged, may be employed with the greatest advantage. The object aimed at is to procure a large amount of transpiration, and the method is apparently immaterial. The Turkish and lamp bath are the most powerful; next, the hot air;[1] then the vapor bath; and lastly, mere hot water.

LOCAL TREATMENT.—When the subacute inflammation, of whose treatment we have already spoken, has subsided, there will be left behind either chronic inflammation or simply thickening. The former we must of course try to subdue, since continuing it destroys the joint. The latter we should endeavor to get absorbed, not only because it produces a certain amount of difficulty in walking, but also because it gives the next inflammation, whenever, and if ever, it may take place, a certain vantage-ground, increasing the difficulty and diminishing the effect of treatment. The inflammatory condition will compel rest in that posture for each joint, which has been described as its proper position; blisters, not immediately over but at some distance from the synovial membrane, are much more valuable than in the strumous form, and if it be intended to give mercury by the skin, blue ointment may be applied to the raw surface; but care must be taken that this surface be not too extended. In these cases, setons or issues, near the joint, are often beneficial; it appears as though the production of a suppurative condition in the neighborhood of the fibre-producing action checked the tendency to thickening. Local heat is very advantageous, particularly as it can be so managed as to produce local transpiration, a method of securing which is described further on.

As the inflammation yields, our efforts are to be directed to procuring absorption. If there be at the special points of pain no tenderness, it is not necessary to keep the limb in absolute immobility, although rest must be enforced if the patient's circumstances in any way admit. A powerful absorbent remedy is to keep the joint wrapped in linen, covered with mercurial ointment, due regard being paid to its systemic action and to the patient's general condition, for if the health be feeble, or if mercury have already affected the system, this method cannot be employed. Iodide of potass ointment rubbed in gently night and morning, and spread on lint wrapped round the joint, is also valuable; and equal parts of this, and of the mercurial ointment, is a very powerful absorbent. Flying blisters, used only as strong rubefacients, not as vesicatories, increase the power of those ointments. Transpiration, produced by fitting to the joint a loose India-rubber sock, kept close at each end by bands of the same substance, and allowing steam to pass in from a kettle or boiler through a tube, has been productive of considerable benefit. When there is absolutely no inflammation whatever, and absorption begins to act, evidenced by decrease in size, gentle shampooing is to be employed, together with passive motion and other manipulations.

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[1] The hot air and the lamp-bath may be arranged in bed.

It is to be remembered that no local treatment will be of much avail as long as the systemic condition lasts, for unless the force of the rheumatic diathesis be diminished the inflammation cannot be entirely subdued, and we may not only expect a return of the more acute phase in the way that has been already described, but also a continual course of deterioration in the articular and periarticular tissues. Many persons who may have recovered from an attack of acute rheumatism, with a sound heart, will subsequently gradually acquire a disease of that organ whose source is undoubtedly rheumatic; and in a similar or rather identical manner a joint will gradually be destroyed by an inflammation of the same character, unless the surgeon will treat the general as well as the local disease.

CASES OF THIS DISEASE.

CASE XXXVI.—Thomas Gwillim, gardener, aged 49, came from Monmouth to be admitted into the Charing-Cross Hospital, under Mr. Canton's care, November 29th, 1858.

History.—About two years ago he sprained the right knee while lifting a heavy wheelbarrow; the joint was very painful, but he kept at his work two days, and then the knee swelled very much and he became unable to walk; but, after fomentations and rest, it got so far better that he was able to resume his occupation. About a fortnight or three weeks afterwards he, one evening, was very tired after work, lay down on the ground and fell asleep; when he awoke it was late night or early morning, and he set off on his walk home (two and a half miles), but before he got there his knee became so painful that he could hardly get on. The next day he could not use the limb at all; the joint was much swollen and he sought the advice of a surgeon, who applied leeches and poultices, without procuring much relief; he then became a patient at the Monmouth Dispensary; subsequently sought the advice of an old woman who gave him something that took the skin off his knee and made him worse.

From that time the joint has continued to increase in size; till of late he was able, with great pain, to work for about two hours most days in the week; often, "when walking right well, his knees seemed to be catched and held tight and to be wonderfully full of pain;" on account of these occurrences he has always, when at work or walking, bound a handkerchief as tight as he could round the knee. During the last year, particularly, the joint has swelled, and he is unable to bear any weight upon it. The knee is a good deal enlarged, but cannot be measured against the other, as, on account of an old accident, there is deformity also of the left. The diseased joint has lost the usual outline and has a square look; the line of the ligamentum patellæ is concealed, and on each side of it there is, instead of the usual fossa, a hard, semi-elastic, non-fluctuating swelling; a similar enlargement is particularly well marked above the patella, where there is a hard lump; there is much thickening under the skin, which is bound down to the parts beneath, and which prevents the different anatomical points from being made out so clearly as they should be; there is some grating when one bone is moved on the other; this causes slight pain; the two surfaces may be pressed together by striking on the heel or other means without producing the slightest pain. He complains much of the limb jumping with severe pain just as he is going to sleep, and so bad is this that often he is afraid to sleep.

The limb was placed on a splint; issues, blisters, &c., as local means, with different forms of tonics, were employed. He also underwent some treatment by the assistant physician, Dr. Hyde Salter, for chronic bronchitis, and was benefited. The knee, however, only got more painful and his health more feeble; the limb, too, started more and more, so that he hardly got any sleep at night. About the middle of January the joint swelled more and soon became fluctuating inside the patella, without, however, losing its square form; and, on the

26th Jan., Mr. Canton punctured the joint with a trocar and canula where the skin seemed thinnest, just inside the patella; so little pus escaped that a second opening was made; yet, altogether, not more than a drachm, or a drachm and a half, of a very thin opalescent fluid came away.

12th Feb.—He was in no wise relieved by the evacuation of so small a quantity of fluid, and as his health seemed giving way under the pain and sleeplessness produced by the disease, it was proposed to him that the limb should be removed, and this day the operation was performed.

Examination of the Limb.—On opening the joint a quantity of very thin pus escaped, with curdy flocculi therein; the synovial tissues were much thickened by false membrane, whose cut edge had a stratified appearance, and was in rounded waves separated by deep wrinkles, which were most marked around the patella and its ligament, and thence ran backward, becoming shallower as they went; the interarticular menisci had disappeared, but were, in part, replaced by false tissue, which, however, was both thinner and less broad than those structures. In no part did the membrane adhere to the cartilage. Thickening was produced not only by this fibrous formation on the inside of the synovial membrane, but also by consolidation of the tissues around it; a faint line, which, however, was in parts obliterated, ran round the joint in this mass of new tissue, and seemed to indicate the position of the synovial basement membrane; the thickening was tough, hard, opaque, and of a brownish-white color.

The cartilages were, in general, very much thinned; there was a small ulceration, which might have been covered by a silver penny, on the inner side of the patella; a still smaller, almost a pin-hole ulcer, on the inner condyle of the femur; and one rather larger, which went quite through the structure at a corresponding spot of the tibia; close to this spot and on the same level with the healthy cartilage, was a surface of polished bone; elsewhere the cartilage was quite smooth; a part on the external condyle of the femur had lost its translucency and become of a dead opaque white; this, on closer examination, was found to be detached, the deep surface was rough, gritty, and was covered by the articular lamella, which had separated from the cancellous structure, and left it bare.

The thigh-bone had, on its inner condyle above the articular portion, a small flat osteophyte, little more than roughened surface; other such growths were scattered here and there over both bones. Both femur and tibia were sawn through, and the portions next the joint were found very red from hyperæmia of the cancellar lining membrane.

Microscopic Examination.—The thickened synovial membrane was examined in two ways: one, by making thin sections with a Valentin's knife through its substance; it was thus seen to consist of a dense structure of which round and fusiform cells appear, at first sight, to make up a considerable part; a little more examination, however, shows that they only lie among and conceal plentiful fine fibres, which cross and recross each other in every direction: another mode of examination was by procuring a fine shred and teasing it out with needles; in this latter method its fibrous constituents became more visible, and it could be seen that they formed the chief part of the enlargement: some of these fibres were made of fusiform cells, others were literally cell-fibres, others were fine and structureless.

The cartilages.—Those parts which were ulcerated on the surface presented the usual inflamed appearance, the hyaline substance gradually changing into fibres; in parts, where the cartilage was detached from the bone, and not ulcerated on the surface, the cartilage corpuscles were also enlarged, were not filled with clear nucleated cells, but with a coarsely granular matter; the hyaline substance around the swollen cells was sprinkled plentifully with granules; the bony spot on a level with the healthy cartilage presented a number of lacunæ in linear order, and with few canaliculi; the cartilage at the borders of this new structure showed the hyaline material opaque and granular, while the cells still retained the arrangement and appearance of ordinary cartilage cells.

Case XXXVII.—J. Leltree, aged 72, came under Mr. Hancock's care into the Charing-Cross Hospital, November 8th, 1859, suffering from long-standing disease of the knee-joint.

There was a good deal of fluid in the cavity, and at the same time much thickening; the joint was loose, permitting of some rotation; the man was suffering a great deal of pain and was extremely weak; he had a bronchitic affection and expectorated a large quantity of mucus daily. His intention in coming to the hospital was to undergo amputation, in order, if possible, to save his life.

Mr. Hancock, therefore, amputated the limb on the 9th November.

Examination.—The synovial membrane was thick and tough, converted here and there into a material of cartilaginous hardness; it contained about two ounces of opalescent fluid; the crucial ligaments had disappeared, which, together with loosening of the external ligaments, permitted the rotation above mentioned. Both interarticular cartilages had disappeared; a part of the inner was replaced by shreds of a fibrous material, which grew from the synovial membrane. The cartilages were, throughout nearly their whole extent, pink in color; in parts where this was but little marked the hue was seen to be due to little pink spots, more or less close together; these structures were quite smooth, except near the outer border, both of the tibia and femur, where they were ulcerated, but they were throughout as thin as cartridge paper; thus the ulcers were of very little depth and their edges were smooth. The articular part of the femur was surrounded by rather small osteophytes; the femur and tibia were sawn through; they were very heavy and solid, the cancelli being nearly filled up by ordinary osseous matter; this density was most remarkable near the joint surface.

The microscopic examination showed, as regards the synovial membrane and periarticular tissues, the same appearance as may be found related in the last case, but those portions of thickened synovial membrane which are said to have appeared cartilaginous had much the microscopic aspect of fibro-cartilage; the fibres were thick and some of the material was void of structure; oval and fusiform cells were thickly scattered among this growth. The thin cartilage exhibited very narrow fusiform cells at somewhat rare intervals, whose nuclei could not generally be found, but a cell here and there presented a lighter, more refracting spot, which might have been a nucleus; the cartilage corpuscles were mostly broken up, the cells lying singly; section of the bone showed thick plates inclosing small cancellar cavities; the osseous corpuscles large and round; the articular lamella had, in some parts, quite disappeared, ordinary bone abutting on altered cartilage in other parts; the lamella was normal in structure, but thin; and in others, again, there seemed to be a transitional condition, some of the ordinary black cells throwing out canaliculi.

Case XXXVIII.—John Middleton, aged 40, a well-grown strong man, was admitted into the Charing-Cross Hospital, under the care of Mr. Hancock, 30th December, 1858, for wound of the knee-joint.

Eighteen years ago he had rheumatic fever, which left the right knee when he went to work, still swollen and occasionally painful; the pains came on, chiefly, at night in bed. Shortly afterwards he severely sprained the joint, which became much swollen and very painful, and has never recovered its natural size and functions; the knee has always remained susceptible of pain after he had had either much work or a long walk. Ever since that time, he has observed also that his knee grated "like two pieces of stone rubbing together;" moreover, it was no uncommon thing for the bones to slip out, when he would replace them and go on with his work. He declares (and he is so intelligent and succinct in his statements that it is impossible to doubt him) that he would tie a handkerchief tightly round his knee, and could then walk at the rate of five miles an hour, or run a mile in five minutes. Last Christmas eve he was splitting wood, when the axe slipped and cut his knee on the inner side: he at once went into the house and to bed; he had surgical care and then came into this hospital.

The wound, in the right knee, was a little in front of the internal lateral ligament, and to some distance round it the skin was red, the soft parts puffy; the joint is much swollen; the sound one measures fourteen inches round its middle and over the patella; the injured one seventeen inches and a half; the swelling implicates the whole synovial membrane, but is most marked inside and above the patella; it fluctuates freely. The wound discharges plentifully, I should say considerably more than a pint daily of turbid opalescent fluid of an oily consistence (synovia and pus); the skin over the joint, except at the wound, was white, shining, and tense; the tibia could be rotated nearly a quarter round with very manifest grating. His countenance is pale and anxious; eyes dull; he is very feeble and evidently in great suffering; pulse 99, thready; tongue white and dry; appetite pretty fair; great thirst; sleeps hardly at all; the limb starts violently when he falls into a doze, and causes such agony that he is afraid of sleeping.

It is not necessary to follow out the details of this case. Under Mr. Hancock's treatment the inflammation subsided, the discharge very much decreased, and the wound had nearly closed; but the bones were so movable, the pain, although much abated, still continued, and there seemed so little chance of a useful joint being ever obtained, that the operation of excision was proposed and the reasons for its adoption explained. It was then that the above remarkable details of the abnormal mobility of the joint were obtained. Seeing that these were received rather doubtfully, he said: "Oh, I will show you;" and immediately, before he could be cautioned, he dislocated his tibia, backwards, by contracting the hamstring muscles, the joint being then in a semiflexed position; he afterwards replaced the bone and repeated the performance. The dislocation was not quite, but very nearly, entire; it seemed to cause no pain, but he said it was a little more painful than before he received the injury.

Either on account of this exhibition or from some other cause he suffered a slight return of inflammation, from which he again recovered, and this time with a little more fixity of the joint.

The end of it was, that in the beginning of April he walked out of the hospital with a handkerchief twisted around his knee, in no worse a state than he had been for years. All the surgeons attached to the Charing-Cross Hospital, and I believe several others, witnessed this singular case, and there is no doubt about the man's power of partially dislocating his knee-joint.

CASE XXXIX.—G. Dempster, aged 32, tailor, came to me at the Charing-Cross Hospital January 27th, 1860, with an affection of the left elbow.

He had rheumatic fever twenty months since, which does not appear to have been very severe, and for which he was treated in St. Bartholomew's Hospital. His elbow has been rather stiff ever since, and in July of last year he wrenched it while lifting a weight; it swelled and was very painful; but it was leeched and blistered at King's College Hospital, and he recovered sufficiently to go to work, although he has not since been able to bend it or straighten it fully: four days ago it became painful, and now he suffers from it considerably.

The joint presents a curious appearance; it looks very broad from behind, but the swelling does not encroach either on the fore or upper arm, nor does it gradually diminish, but is abrupt; over the head of the radius the swelling is considerable; the synovial membrane evidently contains fluid, although it is covered by considerable thickening; the tumefaction is irregularly hard and soft; the hardest part is above this olecranon, the softest at the side of the inner condyle; he has a good deal of pain in the joint, of a dull aching character, which increases in bed; he has, also, vague uncertain pains, sometimes in the shoulder and running down the arm to the wrist; no starting pains. Dr. Hyde Salter examined the heart and found no abnormal sounds; tongue brown, rather dry; bowels confined. His arm was placed on a rectangular splint, wrapped in a piece of lint thickly smeared with blue ointment, and the whole covered with oil-silk; and he was ordered a purge of blue pill followed by senna and salts.

1st Feb. There is, he thinks, a little less pain, but the tumefaction is as great. He was ordered a blister, the size of two fingers, on the outside of the forearm above the joint; reapplication of the blue ointment: he is to drink no beer, but two ounces of gin, in water, daily.

To take the following three times a day:—

℞. Iodinii gr. ⅛.
Potassii iodidi gr. iij.
Aquæ ℥j. M.

6th. Better; the pain and the tumefaction both less; the gums are just beginning to be touched with the mercury; to discontinue the blue ointment; to wash the arm carefully with hot water.

10th. The signs of mercurialization having disappeared he was ordered to wrap the joint in a mixture of equal parts of the blue, and of the iodide of potass, ointment.

19th. The pain has now subsided, and the tumor is less; the slightest signs of mercurialization are present.

2d March. He has been carefully watched that the mercury might not go too far; it was ordered to be discontinued on the 29th. The arm is now free from pain, and painlessly movable to a certain extent; the muscles a good deal set by the long confinement: splint to be discontinued, but he must keep his arm in a sling, and is ordered to bathe the joint in very hot water night and morning.

16th. He was permitted to go to work, carefully, for a few hours in each day last week; he considers himself well; but it has been explained to him that treatment is required to prevent a relapse, against which he cannot feel sure until the joint has returned to its normal size. Ordered to cease the iodide of potass, as his health is a little enfeebled, and to take one ounce of guaiacum mixture thrice a day. I described to him a sock of India-rubber which might be fitted on the elbow and be connected with a tube whereby he might give the part a vapor bath, for as he was a tailor, and apparently a clever fellow, it struck me that he might make one, and to-day he brought me a thing which, as it does not require to be absolutely water-tight, he finds answers the purpose; it is rather clumsy: to use this bath every night, after which the joint is to be wrapped in flannel.

6th May. He has been going on very well; the arm is quite normal in appearance now; he can bend and straighten it to the full.

Since the last date I saw this patient but once again, when he continued well.

I might multiply instances of this disease. I have notes of a case in which it occurred in the knee of a gentleman after standing in the water a whole day salmon fishing in Scotland. In this very small doses of bichloride of mercury were given with tar cum, as the liver appeared very sluggish; no return as far know has occurred, but the impatience of treatment caused hi leave it off before I thought it desirable. He used the Tur baths in Palace-street under my directions with much improve in his general condition. The expense of these baths renders t somewhat inaccessible to all but the wealthy.

CHAPTER VII.

ON SOME OTHER FORMS OF CHRONIC SYNOVITIS.

THE strumous and rheumatic diatheses are those which chiefly produce or maintain a chronic inflammation of the synovial membrane; but there are besides two other conditions having the same effects: these are syphilis and gout.

Syphilitic synovitis, although rather rare, is sufficiently common to deserve some notice. A case of this disease, rather more acute than usual, was detailed at p. 48. I have seen three others whose origin was undoubted, and several where such cause might be suspected. The previous and immediate symptoms of these cases have led me to the belief, that the inflammation always spreads from the neighboring periosteum, with which, as we have seen, the subsynovial tissues are continuous. In two cases, reported at the end of this short section, nodes on the shin were actually present at the time, and were giving severe nightly pain; in others the characteristic sensations produced by these swellings had only just subsided; one of them, close to the joint, had been opened and the wound had just healed.

Syphilitic eruptions are generally present at the very time when the joint attack commences, and by proper inquiry a specific history can always be made out. I am not aware of any case in which this disease has occurred previous to other constitutional effects of the *lues.*

The disease is confined to the middle period of life; its usual history is this: The patient having been subject to the usual secondary and tertiary symptoms of syphilis, labors during some days or weeks, previous to any complaint having been made of joint disease, from nightly pains of the bones; probably also from swellings along the course of the shin bones; with whose aspect and history every surgeon is but too well acquainted; then at some period a joint becomes painful, and swells. At first the tumefaction of the part is slight, and is not so much due to effusion of fluid into the cavity as to an exudation into the periarticular tissues: this is evidenced by the want of fluctuation and the softness of the parts beneath the skin; they do not pit, but they have a tendency to do so; very slight pressure with the finger whitens the part. Soon after the commencement of the disease, an augmented effusion of fluid into the synovial sac takes place; increased heat is perceptible, and occasionally the skin has a pink flush. The pain is, at the early stage, very severe, particularly while the patient is in bed, and at the first commencement of the disease; when increased secretion into the cavity has taken place the pain very much subsides.

The course of the cases is various: sometimes they are quite chronic, at others subacute; but I have never seen one advance to ulceration of cartilages, or permanent injury of the joint, though it is perfectly conceivable that a constitution, combining both the scrofulous and syphilitic taint, might set up an action in the synovial membrane whose termination would be destructive. The disease is most prone to attack the knee and ankle; once I have seen it in the elbow, and once have observed a suspicious case at the wrist; neither of these, however, were under my care; the former was one of Mr. Canton's patients, the latter I only saw for a few minutes, and, as the gentleman was homœopathically treated, declined to give any opinion. It appears probable, if we may build on the history of a single case, that the joint malady may recur when the other secondary events of syphilis return.

The general treatment of this disease is the treatment of syphilis: it is well, however, to remark that considerable debility may be combined with the synovial disease; such state was evident in two out of the four cases quoted, and I have observed it in some which were not under my own care. Mercury, if not already pushed sufficiently far, should be given in small repeated doses, and the value of the iodide of potassium need hardly be insisted on. The combination of tonics with these remedies is most desirable. In one case quinine and mercury, in pill, twice a day was productive of great benefit. The bichloride of mercury with iodide of potassium and gentian form a valuable mixture. The local treatment is first of rest, with a fitting splint to secure immobility of the joint, and superficial counter-irritation by means of blisters, or of flying blisters, only kept on long enough to produce considerable redness of the surface without vesication; the redness may afterwards be kept up by the tincture of iodine. It would seem, from the fact of pain being most severe when the patient gets warm in bed, that cold would be a soothing application; this, however, is far from the fact; heat, by means of hot salt or hot-water bags, although producing pain for the first few minutes, procures a more rapid relief than cold. The cases are quite amenable to antisyphilitic treatment combined with the above simple local management.

Case XL.—William E., aged 33, tailor, came to my house with pains and swelling in the knee, 22d January, 1856. He is a pale, sickly-looking man: the swelling of the knee began two days ago, with much pain, which increased at night; the tumefaction has not the shape of an acute synovitis, but is more diffuse, without defined edge, and conceals the shape of the bones. There appeared to me something anomalous in his symptoms which I did not make out clearly at the time. I ordered him a purge, and a blister above the joint, and to keep his bed until he came again.

26th. When he came to-day I observed an eruption, which turned out to be syphilitic lichen. On examining the tibia I found two dusky spots which had been the seat of abscess from nodes; no recent nodes were apparent, but the edge of the tibia was rough with old ones. I ordered him three grains of iodide of potassium and infusion of gentian three times a day; applied a gutta-percha splint to the limb; told him to keep his bed and to come back in a week.

2d Feb. He is in much the same condition; the man's appearance is very weakly, but it is doubtful if he can get well without mercury. Ordered to continue the mixture and to take following pill night and morning:—

℞. Hydrarg. c. cretâ gr. ij.
Quiniæ disulphatis gr. ij.
Mist. acaciæ q. s. M.

Another blister to the knee; complains of very great pain in the joint at night; told him to apply cold water.

6th. Cold water increases the pain, although the same effect is produced by the warmth of bed: to apply very hot salt bags; this relieved the pain after the first few minutes: add to each pill half a grain of opium.

13th. The knee is much better; is still swollen, but is almost free from pain: the eruptions continue.

19th. The gums slightly sore; the eruption fading; to take the pill only at night.

26th. Eruption nearly gone; to leave off the pill; the joint being still swollen it was tightly strapped.

March 3d. Joint nearly reduced to its normal size; strapped once more; to continue the mixture for another fortnight.

April 7th, 1857. This man came to me again with sore throat, syphilitic eczema, nodes, and pain of the right knee, close to which one of the nodes is situated; the knee is very slightly swollen, is also slightly tender; he is in a very weak condition; has been feeling ill for the last fortnight, and has given up beer, thinking it better to do so, although he has been used to take about a quart (?) a day.

Ordered that he should take a pint and a half of stout a day, and the following draught thrice a day:—

℞. Liquoris hydrargyri bichloridi ʒj.
Inf. gentianæ comp. ℥j. M.

I put a pasteboard splint on the outside of the limb and told him to paint it with iodine.

12th. The knee is more swollen, but is rather less painful and tender; it does not fluctuate, is rather red, and has slight tendency to pit; the tumefaction is more around than in the joint. Add to the draught

Spt. ætheris chlorici ♏x.
Potassii iodidi gr. iij.

Leave off the iodine paint and apply hot dry fomentations by means of salt-bags.

19th. The knee is greatly better.

The splint was only necessary for a fortnight longer; the same treatment was pursued: the rest of this history is merely that of syphilis.

Case XLI.—John Stedman, aged 19, came to me at the Charing-Cross Hospital with syphilitic lepra, and with nodes on the shins.

7th April, 1858. He is a robust, coarse-featured lad, and it seems that he has had the eruptions a fortnight, and thinks little about them, but he wants to be cured of the pains in the shins, which came on about a week ago: the chancre has only just healed; he is very uncertain about the time of its appearance, and has had no treatment besides taking an occasional dose of salts and using a lotion.

Ordered five grains of blue pill every night, and

Mist. potassii iodidi comp. ℥j three times a day.

14th. He complains of pain in the right ankle, which is swollen; there is a slight increase of fluid in the joint, but the chief swelling is external; it has not that anklet-like form over the junction of leg and instep which effusion into the joint causes; the pain seems very severe; there is a node, which is very tender, close to the ankle on the outer side of the tibia, or anterior edge of the malleolus, which is involved in the general swelling. He was ordered a blister over the front of the tibia; a gutta percha splint; to rest in bed and to come in a week.

21st. The ankle is rather better; the nightly pains still continue severe; the gums not all touched by the mercury: to discontinue the blue pill. Add to the mixture:—

Liq. hydrargyri bichloridi ʒj.

To paint the tibiæ and the painful joint with tincture of iodine.

26th. The gums are slightly affected; the ankle is better; the nightly pains have almost disappeared, but still keep him awake: to take a grain of opium, in pill, every night.

May 3d. The nodes are nearly gone, and he has but little pain either about the ankle or shin-bone; the swelling about the ankle not diminished as much as could be wished; the gums are sufficiently affected; the bichloride of mercury is to be left out of the mixture: to continue the application of iodine.

17th. The eruptions, which have been diminished, are now nearly gone;

inflammation of the ankle and the nodes are well: to continue his medicine another week.

Case XLII.—Valentine Mayer, aged 38, an obese Alsatian, came to me at the Charing-Cross Hospital in the early part of May, 1860, with violent pains in the shin-bones; nodes plainly to be felt beneath the skin of the tibia; the dark marks of old ones still left. She had Plummer's pill night and morning, iodide of potass thrice a day, and the shins were painted with iodine at night. For the first fortnight she got better, but after that time was worse again; I strongly suspect she drank a good deal; the medicine had but little effect.

June 4th. Began to take notes of the case because the knee-joint became affected with violent pain; there was little else than this fact to be made out: the knees were both so fat and fleshy that I could not determine the presence of any swelling; the joint was apparently tender, but her gestures and expressions seemed highly exaggerated: she said the pain came on chiefly at night, and walking only hurt her a little: there was no fever nor any symptom of acute rheumatism. Being willing rather to see whether these symptoms were real or not, I merely ordered a local application of arnica lotion, and told her to continue the medicines.

6th. Just the same: she says the cold gives her more pain; there is, perhaps, a little swelling, but it is still doubtful: to bathe the knee in hot water.

8th. The joint-cavity is now evidently full of fluid, and the pain has very much decreased: a blister to be applied across the lower part of femur; a gutta-percha splint at the back of the limb; the mercury has no effect: to take the following pill every night:—

℞. Calomel gr. ij.
Opii gr. j. M.

And thrice in the day

Mist. potassii iodidi comp. ℥j. M.

To return at the end of a week.

15th. The swelling in the joint has decreased; the skin where the blister was applied is still red; the pains in the shins better: continue the pills for another week, unless the gums get sore, every night and morning; if they become tender, to take them only every night.

22d. The knee is reduced to its natural size; is still a little painful at night; gums very slightly affected. Pill every night only.

29th. The knee is well: the rest of the case refers only to the other syphilitic symptoms.

Gout is a disease produced by the presence in the blood of uric or lithic acid; the local manifestation is caused by the deposit of this material, in combination with soda, in the various tissues of the joints, producing a periarticular inflammation, accompanied with great pain and more or less effusion. It hardly comes within the scope of this work to describe fully either the symptoms, the treatment, or indeed the general pathology of this disease; but a few remarks upon the mode in which the local action is produced appear desirable.

The attacks of gout, like those of rheumatism, come on at irregular intervals, although the poisonous matter accumulates regularly in the blood. There are some springs which only flow at certain periods, being supplied by a natural cistern, that only allows escape when quite full, and then does not cease to run till the receptacle is empty; so it seems that the uric acid may go on accumulating to a certain point without producing any painful symptoms, and that then a severe attack will come on, with or without some accidental exciting cause. Each of these attacks is attended with a more or less rapid and plentiful deposit of lithate of soda into the soft textures of the joints; generally at first of the small joints, as of the toes or fingers; but sometimes a large joint, as the knee, the largest in the body, will be the only one affected. (See Chapter III., Case XXI.)

In the acute attacks of the disease, a quantity of the salt is partly dissolved, partly suspended in the synovial secretion, giving it a milky or rather a chalk-and-watery appearance, and when the fingers are moistened with this material, and it is rubbed between them, it imparts a gritty sensation—at the same time a larger quantity of fluid than the norm is secreted; during these attacks, and also during a more chronic and persistent suffering, the urate of soda is deposited in the cartilages, the periarticular tissues, ligaments, and even in the bones. The deposition takes place in the form of a chalk-white gritty powder, in which, under the microscope, acicular crystals are found to be abundant. Owing to the opacity thus produced, there is considerable difficulty in seeing the histological position in which the salt is stored; but from many investigations which I have made, it seems to me that the atoms group themselves round the cells of the various structures.

The cartilages are sometimes found covered on the surface with the lithate; this happens during the most acute phase of the disease, while the joint secretion is rendered milky; the salt then slowly deposits itself on all surrounding parts. Frequently are to be seen little white spots in the substance of the cartilage, and if sections be made through these with a sharp knife, they will be found broader and larger in the depths, than on the surface of the structure. The opacity in these places is so great, that it is impossible to procure sections thin enough to be transparent; but by teasing out portions very minutely with needles, it may be seen that the lithate occupies chiefly the hyaline structure close to the edge or wall of the corpuscles, while the cells themselves remain free up to a certain point. At some period, however, the cell-walls become invaded, the cells themselves atrophied, when ulceration of the cartilage commences.

In the periarticular tissues and ligaments, the same mode of deposition is followed; the cells remain themselves free from the salt for some time after the fibrous intercellular structure has been invaded. This can only be seen by careful and minute division with needles. In a case that was very far advanced (Case XXI.), I found the whole internal lateral ligament of the knee converted into a cyst, which contained a lump, about as large as the last joint of the thumb, of the lithate of soda.

The bones, on account of their solidity and the compactness of their elements, receive this deposit much more slowly than the softer tissues. In them also it occupies a position round the bone cells, filling up the intervals between the canaliculi.

The histological sequence of this deposit carries out entirely the pathology of other joint inflammations, as laid down in this treatise. I would only remark, in conclusion, that the case above quoted is a strong argument against the sharp line of demarcation which has lately been drawn between gout and rheumatism, since that disease commenced in the inflammation of an acute rheumatism, and the joint after amputation was found completely occupied with the gouty *materies morbi*.

CASE XLIII.—Mr. Dalton, of King William Street, was good enough to ask me to accompany him to a post-mortem examination, as he thought there were points in relation to the joints which might interest me, 19th January, 1860.

The man had been long subject to gout attacks: he had died suddenly in the night of the 17th, after eating voraciously of beefsteaks.

The left knee-joint was painful a day or two before death; it presented now a slightly swollen appearance. On opening the synovial sac a little more fluid than usual was found; it was rather turbid: the inner surface of the synovial membrane was perhaps a little redder than normal; there were one or two white spots upon it which could be wiped off with the finger, also one or two others which could not be thus wiped away, but seemed covered by a thin membrane: the cartilages had some removable powder scattered here and there upon them, also some fixed spots; that of the patella was chiefly thus affected, and it was ulcerated in one spot about the size of half a pea, near its outer edge. I brought away with me the patella and a large portion of its ligament; also, some of the synovial membrane, in which the white spots were fixed, and some of the loose powder.

Microscopic Examination.—The powder was found to contain plentiful acicular crystals of lithate of soda. Cartilages: a section through the whitened spots showed that they were all broader and larger near the attached than the free surface. I could not get any section thin enough to enable me to see the locality of the deposit; the whole spot was opaque; I tore it to shreds with needles, and washed away the loosened lithate of soda by a stream of water; the section was still very opaque, but here and there a cartilage-corpuscle could be seen; in these cases it was evident that the powder was situated in the hyaline structure, and not at all in the cells, two of which being set free were found unoccupied by the deposit. Where the cartilage was ulcerated the hyaline structure was split into fibres, between and upon which the lithate of soda was situated; this was seen by treating the specimen as an opaque object: as a transparent specimen this part of the cartilage could not, in its natural state, be used, but I tore off some fine shreds and treated it under the microscope with very dilute nitric acid, and then the cells were found shrivelled and collapsed with puckered walls; this appearance gradually came to light as the salt dissolved.

The ligamentum patellæ had, near its centre, one spot of the chalkstone; this part was cut out, a fine shred clipped off with the scissors and torn with needles under water; after much labor three of the fusiform cells could be made out without any deposit on their walls; the material was accumulated round the fibres; the same was the case with the subsynovial tissue.

The bone was very thick and dense; a section carefully thinned and washed showed parts perfectly opaque, in all likelihood from an accumulation of the lithate of soda, but these opaque spots never encroached on a lacuna; they were around these spaces and concealed many of the canaliculi: the articular lamella and subjacent cancelli were opaque beneath the spots of deposit in the cartilage.

It may have been observed that, while acute inflammation of the synovial membrane has been described as arising from several causes, some of them accidental, others constitutional, the chronic attack has been at present only described as having its root in some cachexia or diathesis: the truth is, that an inflammation of the synovial membrane never commences in a chronic form unless from a constitutional cause. When an acute attack subsides, it either sinks into a chronic state, wherein the disease, although sluggish, is essentially an active condition, or it may sink into a merely passive state of venous congestion. The chronic inflammation, not complicated by any constitutional evil, is easily combated by rest, mild antiphlogistics, or counter-irritants, followed by judicious use of frictions such as are amply described in other chapters, but principally by pressure with strapping plaster.

The passive congestion is accompanied by certain symptoms, the most prominent of which is a superabundance of fluid in the cavity of the joint, and this condition has acquired the name of Hydrarthrosis. It always happens that when a disease is named simply from its most prominent symptom several pathological conditions become confounded together under one designation; as under the term dropsy we may find a renal, cardiac, or hepatic disease, or indeed a mere condition of thin, imperfectly assimilated blood. It is often, however, very inconvenient to change nomenclature, hence the different states which produce great excess of fluid in joints without possessing an active inflammatory character must be the subject of the ensuing chapter.

CHAPTER VIII.

HYDRARTHROSIS.

PATHOLOGY.

THE term Hydrarthrosis, and the more ancient one, Hydrops Articuli, denote simply that the joint contains an abnormal amount of fluid, without any reference to the cause of its accumulation; but there are in reality two sorts of disease which produce this effect, the one unattended, the other attended, by structural alteration of the synovial membrane; the former of these conditions is that which we glanced at in the previous chapter as being merely passive congestion of the vessels, left after acute inflammation. We know that the boundary between congestion and chronic inflammation is most difficult to draw; the absence or presence of changes in tissues, as the distinguishing point, is often variable, for the former state is itself apt to overstep its own passive limits, and to set up some slow but active alterations; hence in this form of hydrarthrosis occasionally a slight inflammation will be present, though the state generally is congestive only, and the weight of the fluid itself produces thickening of some of the surrounding structures, by a nutrient rather than by an inflammatory act. It is rare that we have an opportunity of examining pathologically cases of this disease. The first report in Sir B. Brodie's *Observations on Diseases of the Joints* appears to me to belong to this category:—

"A middle-aged man was admitted into St. George's Hospital in September, 1810, on account of a disease in one knee; the joint was swollen and painful, with slight stiffness, and with fluid in its cavity; the swelling extended some way up the anterior part of the thigh, behind the lower portion of the extensor muscles; it subsided under the use of blisters and liniments. Two months after his admission into the hospital the patient was seized with a fever, apparently unconnected with the disease in the knee, of which he died. On examining the affected joint the synovial membrane was found more capacious than natural, so that it extended up the anterior surface of the femur at least an inch and a half higher than under ordinary circumstances. Throughout the whole of its internal surface, except where it covered the cartilages, the membrane was of a dark red color, the vessels being as numerous and as much distended with blood as those of the conjunctiva of the eye in a violent ophthalmia. At the upper and anterior part of the joint a thin flake of coagulated lymph, of the size of a half-crown piece, was found adhering to the inner surface of the synovial membrane; there was no other appearance of disease, except that at the edge of one of the condyles of the femur the cartilage adhered to the bone less firmly than usual."

The case is superficially reported, and the post-mortem appearances are not given with that exactitude which generally characterizes Sir B. Brodie's own observations, so that I am led to conclude that the distinguished author did not himself see this subject either during life or after death. The distension, however, of the sac, its extreme vascularity, with only one thin shred of lymph, would point to a congestive condition, more particularly as the quality of the fluid being passed over it may be concluded that it was clear —at least was not puriform.

Case XLIV.—Benjamin Savage, aged 17, weak, emaciated, was brought to me by his mother 15th July, 1857, for a burn he had received by falling in a fit upon the fire. The boy's fits have got worse lately; he is of weak intellect and getting still more so; he also grows thinner, although his appetite is voracious; he has a very bad cough and expectorates a great deal.

His mother showed me his right knee, which was much swollen. It appears that two years ago he had an accident to the knee, causing great pain and swelling, and he was taken to the Middlesex Hospital; the joint was well when he came out, but for the last fifteen months it has been enlarging; it does not appear to produce pain, but only causes him to walk with the knee a little more straight than the other. The burn was treated and the knee strapped: I was desirous, after a time, of injecting the joint, but the mother did not seem inclined to let him undergo any treatment. The parents lived close by the hospital, and he was constantly being brought to me for something; he kept getting weaker, expectorated more, and had longer fits; and, at last, on the 5th or 6th October, 1859, he died.

7th Oct., 1859. I obtained permission to make a post-mortem examination, simply for the sake of seeing the state of the articulation.

During life the condition of that joint had been as follows:—it was very much increased in size, simply by the presence of fluid in the cavity; the periarticular tissues were not at all swollen; the fluid felt very near the finger; the chief tumefaction was at the front of the thigh, considerably above the point to which the synovial membrane ordinarily extends; the patella was pushed rather forwards, away from the condyles of the femur, but not so much so as is the case in acute synovitis, with infinitely less accumulation of fluid; there was a little bulging of the joint on each side the ligamentum patellæ; there had been no pain, except if he attempted to flex the leg considerably, but the joint was rather stiff.

The skin was reflected carefully back from the front and sides of the lower part of the thigh; the muscles, namely, rectus and vasti, were seen pale and thin, particularly the two last; they seemed spread out and their fibres separated; when the rectus was turned back the same was found to be the case with the crureus; these muscles were dissected as low as could be managed from the white glistening outer walls of the pouch that extended high up beneath them, and this was punctured in such manner as to prevent, as much as possible, any loss of the fluid; the sac was then opened up by turning back the patella; there was extreme redness and vascularity of the inner surface of the synovial membrane; this was most marked in the folds between the femur and the interarticular cartilages, also at the sides of the patella, but there was one part in the subcrural sac which was intensely congested; the folds first mentioned were very velvety in texture, owing to turgescence in the vessels, but the substance of the villi themselves did not seem increased; the cartilages had become soft and had lost their opal bluish sheen; had become dull, milky, and soft, so as to take the impress of the nail; upon the anterior crucial ligament was a little cyst containing serum, the size of a pea, very like a blister; there was no shred of false membrane anywhere upon the surfaces of the joint, neither floating in the liquor. The fluid was eleven ounces in quantity, straw-colored, with some round spots like oil on the surface; it had lost all thready quality, but had still a lubricating feel; it was very like the fluid of hydrocele, and contained a good deal of albumen; under the microscope the bottom of some, left standing in a conical glass, showed a few round cells.

The textures around the joint were next examined; they were found thickened, white and glistening; the increase was not by addition of crude unformed textures, but apparently by simply greater nutrition of the normal parts, that is to say, the growth was uniform: there was no distinction of old normal and new abnormal textures.

Such a state of parts is sufficient to show the absolutely passive quality of this form of the disease; there is, however, no doubt that such a condition may come on without any previous acute attack. A hydrocele is generally without inflammatory commencement. Hydrarthrosis is more rarely primary, but it may be produced by pressure on the vessels above the situation of the joint.

Another form of disease is that which brings with it, or is caused by, a certain alteration in the structure of the synovial membrane, and these alterations, beginning in slight and simple changes, become afterwards very remarkable and striking. Dupuytren was the first who described this very curious condition, having observed it in the person of a criminal whom he dissected after execution. His account is as follows:—

"Both knees had attained a considerable size, but the skin covering them had undergone no change. At both sides of the patella were situated oblong tumors, rising up vertically above that bone, and in them, as also in the lateral portions of the joint, fluctuation was distinct. On opening the joints there flowed twelve ounces from one, thirteen ounces from the other, of a viscous, thready (*filante*), slightly red fluid, having a flat odor difficult to characterize, and a rather salt flavor; its gravity was to that of distilled water as 105 to 100: the articular cavities containing this prodigious quantity of fluid had increased almost entirely by their upper part. The synovial capsule rose up under the tendon of the *triceps femoris* four inches above the articular surface of the femur; the sides of the joint cavity were much dilated before and behind the lateral ligaments, the posterior portion had suffered no distension; the internal surface of the sac, redder and thicker than natural, was studded throughout with pellets (*pelotons*), unequal in size and volume, supported upon pedicles of different breadth, from which could easily be squeezed a fluid like that contained in the synovial cavity; the neighboring parts were healthy, and all the other joints of this person were in their natural state."[1]

M. Bonnet also reports a case in which he had examined a joint affected with this disease. I will quote as much as is necessary in this place.

"*During Life.*—The knee was much larger than that of the opposite side, painful, without any change of the skin, and offered manifest fluctuation, chiefly on each side of the patella. The leg was extended on the thigh; flexion very difficult, and stiffness in the joint considerable.

"*Autopsy of the Left Knee.*—We found still some traces of the liquid, which had seemed to be entirely absorbed. The synovial membrane was opaque, slightly thickened, and partially fibrous; its internal surface was red and bristled with vascular tufts, chiefly in the parts which surround the patella and in those situated above that bone; the membrane covering the crucial ligaments was unaffected. On those spots where the structure was red, there were some false membranes which appeared of recent formation, but in other parts these membranes had become adherent.

"The right side presented the same appearances, but in a less advanced stage. The synovial membrane was less red, but still was slightly injected, thickened, and contained about 100 grammes of a yellow liquid."[2]

These tufts, which are generally, although, as we have seen, not always, present in hydrarthrosis, are merely exaggerations of the villi which are normal to synovial membranes, and they become thus enlarged whenever the secretion into the joint is increased.[3] Sometimes each tuft is swollen at the end, bearing a resemblance to a currant on its stalk; or the secondary sacculi may be enormously distended, so that each tuft becomes a branching growth from the inner surface of the membrane. These hypertrophied portions generally contain fluid of the same consistence as that in the joint; very frequently also they are hardened and cartilaginous, so that there may be found several considerable pieces of cartilage hanging upon thin stalks. These overgrown processes may sprout so thickly from the membrane, that they form altogether a large mass which, unless the quantity of fluid be very great, produces a doughy, unevenly hard and soft, enlargement at the sides of the joint. It may happen that when the hypersecretion is allowed to flow away, these masses first come within the surgeon's range of touch; or occasionally the tumefaction, which was at first entirely due to fluid effusion, becomes more and more indebted to the outgrowths of the synovial fringes until (none of the fluid having been artificially evacuated) the enlargement is found to be almost entirely produced by the hypertrophy of these bodies.

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[1] Dict. des Sciences Méd., t. xxii. p. 148.

[2] Maladies des Articulations, t. i. p. 430.

[3] The mere watery exudation from congestion is not *secretion:* hence, in the instances first quoted, the tufts were not enlarged.

This disease is, generally speaking, connected with the rheumatic taint; the great growth of the tufts, the occasional hard swelling at their ends, connect this form of hydrarthrosis, on the one hand with the peculiar false cartilages in joints, on the other with that malady called chronic rheumatic arthritis. Again, the rheumatic tendency to organize is seen in the occasional transformation of the subsynovial tissues into cartilage, sometimes into bony matter, surrounding the joint in an annular form, or more rarely branching in an arborescent manner over the synovial membrane.

After a time—be it from change in the nutritive condition, be it from the soaked state of their tissue—the cartilages may become fibrous, and then ulcerated: this is always accompanied by a turbid condition of the fluid; indeed, there are cases in which the fluid becomes more purulent than synovial.

SYMPTOMS.

The appearances which this disease produces have been pretty accurately detailed in the cases already quoted. The accumulation of fluid in the synovial membrane causes a tumefaction, which is limited by the walls of the sac, and which fluctuates freely from side to side. After a time, the hypersecretion becomes sufficient to distend the synovial membrane, and to make it yield in that direction in which the least resistance is offered. Thus, at the knee-joint, the patella will be pressed a little forward, away from the femoral condyles, and at each side of the ligament will be a certain amount of bulging or tumefaction, also at the sides of the joint a good deal of swelling, girt in by the lateral ligaments; but the greatest amount of enlargement, that which chiefly will attract attention, is above the knee-joint, in the subcrural sac, grooved lengthwise by the rectus tendon. Such are the early appearances, but later in the disease, the areolar tissue thickens so much wherever the weight of the fluid produces pressure, that the tumefaction below becomes less, while that above becomes more marked. Throughout the case, fluctuation from one part of the joint to the other is perfectly distinct. At the elbow, where the disease is next in frequency to the knee, the swelling is chiefly on the inner side, over the internal condyle, but also runs up the back of the arm under the triceps muscle, and fluctuation may be felt from one part to the other, or from either to the junction between the outer trochlear surface of the humerus and radius.

These positive symptoms prove that there is a certain amount of fluid in the joint cavity. Beyond this point we depend for our diagnosis upon negative signs. The absence of inflammatory symptoms and fever shows that we have not to deal with an acute synovitis, while the absence of any far advanced debility and hectic shows that the fluid is not pus.

This condition of joint is accompanied by a certain amount of stiffness; the limb naturally assumes that position which gives most room to the fluid, and any change in this posture, causing more or less pressure, produces proportionate pain. Hence the stiffness is in the earlier stages directly proportionate to the amount of fluid distension.

In the beginning of the complaint there is no possibility of judging, from the symptoms then present, which form of the disease we have under our notice; the past history must help us to the conclusion. Hydrarthrosis from mere congestion is a sequela of an acute inflammatory attack; while, if it result from hypertrophied fringes, the history will probably be that of a disease throughout chronic. Even that form of malady, which commences by mere congestion, is apt after a time to put on some of the appearances of the other species. Hypersecretion is not only produced by, but also produces enlargement of the synovial papillæ; passive effusion causes very slight increase of these bodies in proportion to the amount of fluid in the sac. In that kind of hydrarthrosis, whose origin seems to be hypertrophy of these processes, the amount of solid matter is after a time in considerable ratio to the amount of fluid; so much so, that the enlarged fringes can be felt as fleshy, doughy masses in the sac; more or less movable, more or less apt to glide away under slight pressure. Such fleshy growths are situated in the knee, chiefly at either side of the patella, between it and the lateral ligaments; in the elbow behind, and above the inner condyle.

TREATMENT.

The early symptoms of hydrarthrosis are not always, as we have seen, alike. The disease is sometimes the remnant of an acute inflammation, and therefore, when such an attack is declining, it is well worth considering whether, by a certain local treatment too much in vogue, we do not rather than otherwise tend to produce this dropsical condition of joint. If we subdue an acute inflammation by abstraction of blood; subsequently, by blisters (remedies which we know relax the vessels); then apply warm poultices, fomentations, &c., we conduce to this relaxation still more—are in fact using the very means, which we should choose, were we endeavoring to establish a venous congestion.

In several instances I have seen such treatment followed by a troublesome amount of lingering effusion. The sense of distension and stiffness, or the increased size of the joint, may be got rid of infinitely quicker and better, if pressure be applied as soon as the actual acute inflammation has disappeared; very many cases have proved to me the much greater benefit to be derived from such proceeding.

But if a dropsy of the joint have lasted some time, or again if it commence in a chronic form, we may in either case, and certainly in the latter, conclude that some constitutional evil has set up, or is maintaining, the morbid condition. If in such a disease we look to the general symptoms and to the history, the signs of a rheumatic condition will nearly always be found; and when this is the case the treatment of chronic rheumatism may be advantageously combined with the local management; indeed it has appeared to me, that the reason of many failures to cure this disease is in the obstinate employment of local, to the utter exclusion of constitutional remedies. Iodide of potass, guaiacum, James's powder, ipecacuanha, diaphoretics, as recommended in Chapter VI., are the chief means at our disposal. I would, however, exclude mercury and colchicum nearly or altogether from this list. In the above-specified chapter, mercury, both generally and locally, was recommended. We find, in the form of synovitis there described, an inflammation of a highly formative, membrane-producing type, and in such diseases we know how restraining is the action of mercury; but in the malady now under consideration the condition is very different, and the rheumatic action of a depressed form. The local influence of mercurials is probably injurious, as I have convinced myself (a case in point is quoted at the end of this chapter); probably by weakening still further the contractile force of the vessels. The systemic action apparently produces similar want of power.

Antimony in large doses has been employed with benefit: the originator of this plan, M. Gimelle, reports its efficacy in twenty-eight cases. His doses, beginning with half a grain every three hours, were increased little by little until they amounted to twelve grains in the twenty-four hours, and the cure was generally effected in about twelve days.[1] The same plan has found more favor in Germany than it is likely to do in this country, and many reports of cures have been published.

Local means, however, during the employment of these remedies, must be used for the sake of promoting absorption, or otherwise getting rid of the superabundant fluid. Rest has nearly always a very marked effect in reducing the size of the tumor; the horizontal posture of course prevents the weight of a superimposed blood-column acting injuriously in producing venous distension and thereby exudation. Blisters and all sorts of stimulating liniments, tartar-emetic ointment, nitrate of silver lotion, are all occasionally employed with some temporary and but little permanent benefit. Such applications are often, while the patient is at rest, apparently beneficial, producing absorption of the superabundant fluid; but when he abandons the reclining position, hypersecretion again sets in, and the disease returns. Pressure has had, in two slight cases, a better effect, and cured the disease even while the patients were walking about, but it were vain to strive against a confirmed hydrarthrosis by such means.

Simple puncture with the trocar is a merely temporary remedy; but from the sort of fluid evacuated, we may be able to found a diagnosis as to the species of disease. A viscous thick liquid, drawing into long threads rather than dropping, shows a considerable structural change, and it is probable that no means whatever will be able to restore perfect health to the synovial membrane of the joint for months, if at all. A fluid, whether thick or otherwise, which is opalescent and turbid, in fact puriform, shows that the cartilages have more or less yielded to disease, and therefore that entire repair is barely possible. A fluid thinner than synovia, clear, yellow, like the liquor of hydrocele, denotes that very little or no morbid change, according to the more or less watery condition, has taken place; hence many of the means mentioned may prove curative. Even simple puncture followed by strong pressure will in some cases be sufficient to produce the desired result. Acupuncture has been used, and one case is reported in which it was beneficial.[1]

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[1] Mémoires de l'Académie de Médecine, July, 1840.

Subcutaneous section of the synovial membrane is a much better means, and this, combined with pressure, is likely to be followed by permanent cure. M. Goyrand is the inventor of this method: he published the following account of his proceeding:—

"On the 29th December I operated in the following manner: placing myself on the left of my patient (the disease was in the right knee) I pinched up the skin of the thigh at the upper and outer part of the tumor into a large transverse fold, which I let an assistant hold, and pressing with the left hand the patella and lower part of the swelling, so as to distend its upper portion, I plunged through the transverse fold a narrow-bladed bistoury, with a cutting edge an inch long from the point, and blunt beyond this distance to the heel. Having passed the knife sufficiently far under the skin, I freely divided the aponeurosis, the outer and middle portions of the triceps, and the upper and outer part of the synovial sac. Having thus opened the joint, I turned the bistoury half round, so as to direct its cutting edge forwards, and divided all the deeper parts between the skin and the articular cavity, giving the incision into this latter a length of from fifteen to eighteen millimètres (from half an inch to an inch); the bistoury was then withdrawn and the fold of skin let loose: the external puncture drew itself up to four centimètres (an inch and three quarters) above the deep incisions, and is hardly more than a fifteenth of an inch long; some little bubbles of air had penetrated under the skin, and were placed in the track of the puncture. Slight pressure upon the tumor forced out some synovia, which carried the air along with it. I did not endeavor to empty the synovial membrane, as I knew that the liquid would infiltrate the areolar tissue and be very soon absorbed. A little piece of diachylon plaster was put upon the wound: rest in bed.

"30th. No fluid in the synovial membrane: it has infiltrated the loose cellular tissue between the femur and triceps, and forms a tumor which has nearly the shape of the hydrarthrosis, but is not fluctuating. The patella

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[1] Hamburger Zeitschrift, Gädechens, 1851.

is now in contact with the femoral condyle, and pressure upon different parts of the tumor does not displace this bone; there is not the slightest pain. Compression by means of plasters and bandages.

"This patient went on perfectly well. On the 13th of January he desired to leave the hospital, promising to show himself if the tumor returned. On the first of June he had not reappeared."[1]

This case should have been kept in sight if the cure was to be proved, as we know how little reliance can be placed upon the promises of patients. M. Bonnet relates a curious instance, in which a fall had ruptured the membrane and produced a cure.[2]

Certainly, however, injection of the joint by some irritating fluid is the most powerful means of cure at our disposal, and is, even though it be not always curative, so very slightly dangerous, and so seldom followed by too violent an inflammation, that it may be used without fear. Mr. Gay, of the Cape Hospital, Cape of Good Hope, the first who, in 1789, was sufficiently bold to use this means, employed the diacetate of lead for the purpose, and succeeded in curing his patient, a negress, thirty-seven years old. In 1841, Velpeau and Bonnet, in France, took up this plan, and used iodine for the injection-fluid. This material is valuable, inasmuch as it does not tend to produce suppuration; and although several cases have occurred in which an undesirable amount of inflammation has followed, I have not found any reported cases whose results were disastrous, although both in England and on the continent its employment has become pretty general. The mixture commonly used in this country is from a drachm and a half to two drachms of the tincture of iodine, with an ounce of water. The mode of procedure is extremely simple—a trocar and canula are plunged into the joint at some fitting spot; at the knee, above and to the outside of the patella; at the elbow, above the internal condyle, the direction should always be oblique, that the opening may be valvular. Fluid is then allowed to flow out: the hand may be placed over the joint so as to compress it very slightly; but no attempt is to be made to empty the cavity. A syringe, whose perfect fit to the canula has previously been secured, is then to be adapted to the tube, and the solution injected. When the syringe is removed, the finger is to be placed over the mouth of the canula, and the limb is to be moved up and down (without bending or straightening the joint operated on to more than a very slight degree) so that the fluid may come in contact with every part of the synovial membrane. In about a minute the limb is to be turned so that the canula is in the most depending part of the joint, and as much fluid as will escape, under slight pressure upon the synovial membrane, is allowed to flow out. The canula is withdrawn and the puncture closed with a piece of plaster.

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[1] Gazette des Hôpitaux, July 13th, 1842.

[2] Maladies des Articulations, tom. i. p. 431.

It is essential to observe that no air enter the cavity, and for this purpose it is necessary that the syringe have a well-fitting piston, and be accurately full of the liquid. The amount of fluid injected depends in great measure upon the size of the tumor, and therefore in part also upon the amount of liquor previously withdrawn; at the knee it need not exceed three, or at most three and a half, ounces; at the elbow I have found two ounces sufficient. There is one singular effect occasionally produced by iodine, viz., a sudden and considerable fall of the pulse, both in frequency and power.

This is, as we have said, the most powerful means at our disposal for the reduction of hydrarthrosis, but it does not always cure the complaint. It will almost invariably greatly diminish the amount of fluid in the joint; but its effect upon the hypertrophied synovial fringes is less marked. It is probable that their fluid contents are diminished, but their solid enlargement can hardly be thus at once decreased. Sometimes, in those cases which do not depend upon a strongly-marked diathesis, and in which cartilaginous thickening of the parts has not occurred, the morbid addition to their size will diminish. When such thickening has taken place the prognosis is unfavorable, for the disease will probably end in considerable impairment of the joint, or even in slow suppuration in the cavity.

Cases of this Disease.

Case XLV.—Jane Higginson, aged 33, a short, weakly-looking woman, nearly eight months advanced in pregnancy, came to me 1st August, 1856, with a considerable swelling in both knees.

The swelling commenced, without pain or assignable cause, five days ago; she found it accidentally on going to bed at night: the only unusual sensation is slight stiffness. The right knee, the largest, presents a fluctuating tumefaction, chiefly observable above the patella, but also in every other part of the joint; it is not hot, tender, nor red. I ordered her to rest as much as possible, and to put a blister above the right knee: quinine mixture three times a day.

6th. Just the same: a blister to the lower part of the joint; the left knee to be strapped.

13th. Both joints are larger in size, and she now has a sense of distension in them.

To use the following lotion every night:—

℞. Acidi sulphurici fort. ʒij.
Olei terebinthinæ ℥ss.
Olei olivæ ℥iss. M.

18th. The feet and legs are œdematous: this occurrence led me to abandon all irritant treatment, and to tell her simply to come and let the legs be bandaged as frequently as necessary.

3d Oct. As this patient has not been to me for more than a month, I called at her lodgings in Bedfordbury: she gave birth to a child three weeks ago; the œdema of the legs has disappeared, also the swelling of the left knee; the right one is still a little swollen: she has been up five days. I told her to send to the hospital for some quinine, and to come to me in about a month.

12th Nov. This patient came to me; her knees are now of perfectly normal size and shape.

Case XLVI.—Susan Bradly, aged 48, came among my out-patients at the Charing-Cross Hospital 13th April, 1860, with a swollen knee.

The right knee has been painful for about a week; the pain has come on at night; it is now somewhat swollen; the tumor is fluctuating; the patella not in contact with the femoral condyles; slight stiffness, no tenderness, heat, nor redness; she is subject to rheumatic pains, chiefly in the right shoulder, and has attributed the pain in the knee to rheumatism; she is strong and stout: knee to be strapped.

To take the following draught three times a day:—

℞. Liq. antimonii tartarizati (D.),
Spt. ætheris nitrici, āā ʒss.
Aquæ destillatæ ℥j. M.

17th. Knee perhaps a little smaller; reapply strapping.

24th. The knee is certainly better; the swelling has much decreased; knee to be strapped with the emplastrum ammoniaci.

May 5th. The medicine has produced some feverish symptoms and diarrhœa. The following to be taken every six hours:—

℞. Spiritus ammoniæ aromatici ♏xl.
Potassæ carbonatis gr. x.
Mist. camphoræ ℥j. M.

And at night

Pulv. Doveri gr. v.

12th. The diarrhœa and feverish symptoms have subsided; the knee has quite regained its shape; there is a little thickening above the patella: to be strapped again with the same plaster. Ordered to take two grains of quinine, in the form of pill, three times a day.

19th. Discharged; cured.

Case XLVII.—Elizabeth Grant, aged 28, a tall woman with powerfully formed limbs, came among my out-patients to the Charing-Cross Hospital 8th January, 1858, for an enlargement of the right knee.

Six months ago, in doing some household work, she knelt upon a thimble and hurt her knee. It was painful and swollen for three weeks; she rested as much as she could, but underwent no treatment; at the end of that period both the swelling and pain disappeared, and she took no farther notice of the occurrence; but, ten days ago, the joint began to swell again and to be painful. She has been suckling up to the present time: the child is fourteen months old.

The knee is very considerably swollen, presenting a baggy tumefaction, concealing the shape of the bones, and larger in some places than others; one of these is in the lower part of the joint on either side of the ligamentum patellæ; but the chief enlargement is on each side of the rectus muscle. The measurements are

	Sound.	Morbid.	
Above patella	15¼	17½	inches.
Across "	15½	17	"
Below "	13⅞	15¼	"

The tumor is fluctuating; waves of fluid may be made to pass from one part of the joint to the other; there is some appreciable thickening of the periarticular tissues; the joint is neither tender, hot, nor red; she has very little pain, but some stiffness; she can in the morning walk without any limping, but in the evening, and when she has been about a good deal, she has a sensation of "bursting" in the joint, increased stiffness, and is obliged to limp.

I ordered her to wean her child; to have a gutta-percha splint bound to the back of the joint; a blister across lower part of the femur, and the following draught three times a day:—

℞. Potassii iodidi gr. iij.
Decocti scoparii comp. ℥iss. M.

13th. She says that she is obliged to do her work; the splint prevents this, and therefore she took it off; there is no improvement: blister to lower part of joint.

18th. She is no better; I persuaded her to come into the house, and Mr. Canton kindly allowed her to remain under my care. Repeat the blister above the joint and let it be kept open with iodide of potass ointment: bed.

27th. She is not at all improved: let the blister heal.

3d Feb. The blister having healed, I passed a narrow tenotome into the joint, about an inch and a half above the outer edge of the patella, and sweeping the blade upwards, divided the synovial membrane to an extent of about an inch and a half to two inches, and bandaged the knee tightly from below upwards.

5th. She is in no pain: the bandage is quite loose; when it was removed the joint was found reduced; there is still a good deal of swelling, but it is diffused and does not fluctuate: bandage reapplied. To take the following, three times a day:—

℞. Ferri sulphatis gr. ij.
Misturæ quinæ ℥j. M.

12th. The knee was strapped three days ago; she is in no pain: allowed to get up.

23d. There is no appearance of return, but the knee has been kept strapped: discharged.

I saw this patient, casually, on the 8th April, 1859; she has had no return of swelling, and has no inconvenience with the knee.

CASE XLVIII.—Thomas Gaddin, aged 25, cabinet-maker, came under my care at the Charing-Cross Hospital with a swelling of the elbow, 12th May, 1856.

About seven years ago he fell and was stunned; believes he struck his left elbow: within a month a soft swelling formed over the head of the radius; he got some ointment and applied it without benefit. He took no farther notice of the tumor, as he had no inconvenience, except that it seemed to weaken the thumb, particularly when the arm was bent. About six months ago this effect increased to a disagreeable degree, sometimes the hand would be set fast and he would suffer great pain; he applied, by the advice of a surgeon, the tincture of iodine, and about two months ago a swelling began rapidly to form on the inner side of the joint, while that formerly mentioned decreased.

The only unnatural appearance is a large broad-based swelling upon and below the inner condyle of the humerus; this tumor, projecting inwards, and a little backwards, is larger than half a hen's egg cut crosswise would be; it fluctuates through the joint, *i. e.*, from the swelling itself to the junction of radius and humerus; the skin over it is thin; the joint is slightly hot, and, over the most prominent part of the tumor, slightly red. The state of health is not such as would lead me to diagnose pus in the joint; still he is in rather a weakly condition. Ordered the blue ointment to be applied on lint covered with oil-silk.

The following to be taken three times a day:—

℞. Ferri ammonio-citratis gr. x.
Spiritûs ammoniæ aromatici ʒss.
Aquæ destillatæ ℥j. M.

26th. This man has been here two or three times since the last report, and the arm has been getting worse: the skin over the point of the tumor is redder and thinner, in fact it looks as though it would give way; elsewhere it is sodden and relaxed. I believe the ointment has been injurious. As the swelling seems likely to burst and lay the joint open, it seemed to me advisable to prevent this by a puncture. I plunged in a trocar and canula, not at the thinnest, but at the most depending part, in as oblique a direction as possible, and drew away two ounces and five drachms of remarkably viscid synovia, with some nearly transparent flakes; there were many more such flakes, probably, in the joint, as the canula became often stopped, and had to be cleared with a probe. When the joint was empty the canula was withdrawn and a piece of plaster applied to the puncture. A lump could now be felt behind the inner condyle, about an inch and a half in length, somewhat movable, and of an uneven consistence; most of the swelling giving a doughy sensation, and having little hard lumps in it, which moved away, however, when it was attempted to examine them more closely. The limb was bandaged from the hand upwards and placed on a rectangular outside splint. To take one ounce of the quinine mixture three times a day.

6th June. The swelling is rapidly reappearing.

16th. The arm is in much the same condition as when I first saw it: punctured the tumor with a trocar and canula; drew off one ounce six drachms of the same sort of fluid as before. I injected two drachms of tincture of iodine with an ounce and a half of distilled water; in one minute let the liquor flow out, keeping a gentle pressure on the tumor and joint; withdrew the canula and closed the wound with plaster: arm bandaged and replaced on splint. Ordered to take one grain of opium to-night in the form of pill.

17th. He has had a little pain in the arm, but slept well last night: there is, to-day, a little tenderness over the inner condyle: the splint reapplied.

Ordered to take an ounce of the mistura guaiaci three times a day, and a hot bath to-night.

19th. Still no pain in the arm; the soft doughy lumps spoken of in report for May 26th, are to be plainly felt; they are, perhaps, rather harder.

25th. The joint has begun to fill again: let the arm be tightly strapped. The following to be taken three times a day:—

℞. Potassii iodidi gr. v.
Decocti taraxaci ℥jss. M.

7th July. In spite of strapping, which he cannot bear very tightly applied, and of all means that I have used, the arm still continues to swell.

11th. Injected the joint again with a mixture twice as strong as that used before, thus:—

℞. Træ. iodinii ℥ss.
Aquæ destillatæ ℥jss. M.

Very few seconds after injection the pulse, which was 84 in the minute, sank rather suddenly twenty beats; nevertheless, I kept the fluid in the sac for one minute, and then let it flow out: bound the arm on an outside rectangular splint.

14th. I saw the patient on the 12th; there was no pain, and the splint was not taken off: strapping sufficiently tight to press without causing pain: splint.

28th. The splint and strapping have been renewed as occasion demanded, and reapplied; the former may now be discontinued.

13th Aug. The joint is not increasing in size, but it is larger than the other; the doughy lumps previously spoken of are harder, and perhaps rather smaller: leave off the strapping; bandage for a week.

27th. He has been without any application on the arm for a week, but he promises to follow my advice and to have a sort of bracelet made like a laced stocking.

I have lost sight of this man, but consider it probable that the joint has undergone, or is undergoing, a destructive process.

CHAPTER IX.

ON LOOSE CARTILAGES IN THE JOINTS.

PATHOLOGY.

THIS disease is closely connected with that which was the subject of the previous chapter. We found that in one, the most common form of hydrarthrosis, the synovial fringes grow out into tufted processes, whose swollen ends are frequently cartilaginous. This condition is usually combined with so much effusion of fluid that the solid swelling, produced by the overgrown villi, cannot be felt; but it occasionally, though rarely, happens that the synovial membrane is not thus filled, and then the villous growths cause a more or less hard tumefaction. Or it may happen that the effusion, at first very considerable, will after a time decrease, and then these processes come within range of the sense of touch.

But false bodies, generally so called, present themselves usually as one or more movable substances in the cavity of the joint: they are commonly situated in the knee, are less frequent in the elbow, have been found in the joint of the jaw, and in the wrist. Although generally styled loose cartilages, they are very frequently in part composed of bone; sometimes the osseous matter forms merely a nucleus, sometimes one side of the substance will be bony; occasionally, though chiefly in combination with another disease, they are entirely osseous.

It would be hardly warrantable to assert that all false bodies in joints are of rheumatic origin; but it is certain that they are chiefly found in connection with that diathesis; they are very fully and largely developed in the disease called chronic rheumatic arthritis, and are in that malady frequently bony; moreover, are found external to the articular cavity, that is, developed and lying among the periarticular tissues. Such instances belong, however, to the chapter upon that disease; at present we are only concerned with false bodies as they sometimes appear lying movable in the synovial cavity.

No better and more succinct account of these growths can be given than that by Mr. Rainey:—

"These bodies have a distinct investing membrane which on its external surface is smooth; but by its internal one is so intimately connected to the body itself as to admit of being detached only by small shreds.

"This membrane is composed of fibro-cellular tissue mixed with granular matter.

"Their internal structure, as exhibited by a section through their middle, is seen by the naked eye to consist of two distinct substances—the one being semi-transparent, like fibro-cartilage, the other perfectly opaque and white, like bone. The former, under the microscope, presents the appearances usually seen in fibro-cartilage; the latter resembles remarkably in its ultimate structure those bones which consist only of one bony plate placed between two folds of membrane, as the thin plate of the ethmoid. In the bones, the lacunæ, as in the opaque parts of the bodies before mentioned, are the same as in other bones; but there are no distinct or well-formed canaliculi branching out of them. There is in both a stellate arrangement of the earthy matter around the lacunæ, but nothing like canaliculi, and this appearance is more striking in the bones alluded to than in the earthy parts of these bodies.

"I believe no satisfactory explanation has yet been given of the manner in which these bodies are formed in joints, although I think their origin, and the circumstance of their becoming loose in a joint, will appear obvious, by a reference to the remarkable character of the epithelium in joints: the thecæ of tendons and mucous bursæ."

Mr. Rainey then gives the description of synovial villi and their secondary sacculi, already quoted (p. 31), and goes on to say:—

"Now this being the apparatus by which synovia is elaborated in all parts in which this fluid is found, and the bodies thus described being found in these situations, they may be inferred to be the product of disease in these structures; the cellules of these fringes, in the place of elaborating synovia from the blood, producing, under the influence of morbid action, other products, such as cartilage, which becomes converted into imperfectly formed bone. The fact of the secondary sacculi being connected to the primary by extremely narrow pediculi will suffice to explain the reason why these bodies may become formed in the first instance; the pedicle serving both to keep them attached, and to convey the material from the blood necessary for their development until they acquire a certain size; but afterwards, from its tenuity being no longer capable of holding them, it breaks, and the bodies become loose and most likely cease to enlarge."[1]

There can be no doubt that Mr. Rainey is perfectly correct in his views regarding the formation of these loose cartilages; they vary much in size, from a minute point to that of a bantam's egg. In the cases we are now considering they are not generally numerous; although, as we have intimated, they are often so in certain instances belonging to a differently named malady. When they attain any considerable size they cannot slip between the bones of the joint, and thereby produce the painful symptoms peculiar to this complaint; these are owing to abnormal pressure upon the joint-surfaces, a condition which, on account of the peculiar innervation of articulations, always causes muscular contraction.

SYMPTOMS.

The presence of a loose cartilage in a joint-cavity first manifests itself by the production of sudden severe pain, of a spasmodic character, and so peculiar as to make the sufferer feel faint and sick; sometimes actual syncope is produced. This symptom is chiefly noticeable when the disease is situated in the knee; indeed I am not aware that it ever occurs at the elbow, the next most usual seat of the disease; the close-fitting condition of these joint-surfaces would prevent the intrusion of such a substance between the bones. This pain is so severe, and of so peculiar a sickening character, that the sufferer is obliged to sit down wherever he may be; sometimes, indeed, he falls. It is generally brought on by certain movements and positions more easily than by others, which the patient soon learns, and tries as far as possible to avoid; occasionally, on the contrary, it occurs apparently without any provocation, during the simplest positions, even turning in bed, or it may be produced by some slight movement in sleep.

The mere occurrence of this symptom, although it would rightly cause us to presume that a false body had been developed, does not justify any positive conclusion on its existence; because in a few rare instances an interarticular cartilage attains an abnormal degree of mobility, suffers occasionally a partial dislocation, falls between the bones, and gives rise to a precisely similar pain. The only unmistakable evidence of the existence of a loose cartilage is to feel it through the integuments moving about in the articular cavity; but many causes may render this extremely difficult, and inability to feel the body, even repeated failures to find it, are not to be regarded as proving its absence.

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[1] Pathological Transactions, 1848, vol. ii. pp. 110, 111; Mr. Rainey's examination of some false bodies from the elbow-joint exhibited by Mr. Solly.

We have seen that these growths are generally connected with a dropsical tendency of the synovial membrane; moreover, when an attack of the above-described pain has come on, inflammation with plentiful effusion into the joint is set up, and thus much the same effect of an over full condition of the articular cavity is produced: this may be considerable enough to render the detection of a foreign body all but impossible; on the other hand a slight degree of effusion, by giving the body some amount of free mobility, renders its detection more easy. The most usual position for finding such a growth is at the inner side, between the patella and the internal lateral ligament; but sometimes it will be discovered in an analogous situation at the outer side of the joint; less frequently, its favorite locality will be behind either lateral ligament. The body may be extremely movable, any pressure upon it in one of its haunts causing it to slip away, perhaps to reappear in another place, perhaps to lie concealed until some movement of the joint disturbs and makes it return to some part of the surface. This peculiar inconstancy and mobility acquires for it in Germany the name of joint-mouse (Gelenkmaus). Very frequently, however, the body is not so freely mobile, either being still attached so as to have choice of locality only within a certain range, or being too large to pass into certain spaces in the articulation. It follows, therefore, that when the mass has once attained a size which prevents its intrusion between the bones, the worst consequences and the most painful symptoms of the disease naturally end.

TREATMENT.

Two modes of treatment may be indicated: one which endeavors to keep the loose cartilage in a harmless place, and, if possible, to procure its adhesion there; the other, which removes the body altogether. The former of these is usually partly, sometimes altogether, unsuccessful. Its aim is, first, to manipulate the body into a place where it may lie harmless, and then, by some bandage or other means, to fasten it in that locality. To do this it is, of course, firstly, necessary that the cartilage be sufficiently movable either up or down, that it may be brought to lie upon either of the bones, not on the line of junction between the two; for if it be in this latter situation, any pressure exercised upon it will, of course, force the body into the very place we wish to cause it to avoid. When the false body has been manipulated into a favorable place, a laced sock must be so applied as to keep it, if possible, fixed to that spot. It is, however, rare that the growth can be thus fixed; it will remain for a time in the right place, and then from some awkward movement, from the sock having become displaced, or from some other cause, it glides into a wrong position, and causes a return of the pain. It is rare that any bandage can be borne sufficiently tight to keep the body perfectly fixed; but some cases are on record in which this plan had succeeded; the cartilage having contracted adhesions, and remaining fixed in its new position, even after the bandage had been removed.

Another plan which has been tried, and which has failed, is to endeavor to fix the new substance by driving into it needles passed through the skin. The pain and inflammation produced have necessitated the removal of the needles before the loose cartilage has become adherent.

Excision is the radical means of getting rid of these bodies. It has been done by cutting directly into the joint; and when the wound heals by the first intention no bad symptom may follow; but when the incision remains ever so little open, suppuration of the joint with the whole string of evil consequences is very likely to come on. Benjamin Bell first proposed making the incision valvular by drawing up the skin at the part to be incised before cutting into it. If, when the operation is complete, the integument be allowed to return, the wound will be closed.

Monsieur Goyrand, of Aix, carried out a subcutaneous mode of cutting out these bodies, by two distinct operations. The first consists of fixing the body in some superficial part of the articulation, passing a tenotomy knife through the skin, and making in the synovial sac an incision through which the cartilage is pressed into the periarticular areolar tissue. The second operation is performed some days afterwards, when it is judged that the wound in the synovial membrane has healed. It consists simply in cutting down directly upon the loose cartilage now outside the joint and extracting it. Some skill is necessary for the performance of the first operation, because the mobility of the body and its power of gliding away are so considerable. Before attempting it, therefore, the surgeon must carefully have learnt the habits of the cartilage; must know in what direction it chiefly tends to slip, and in what places it most readily hides. He should endeavor to press it as far away as possible from the line of junction between the bones, to the place where the synovial membrane is reflected away from the periosteum. The choice of locality is not always with the surgeon; for sometimes even the greatest skill will not suffice to make the cartilage take up the position which may be most desirable. This is at the knee, over the inside of the head of the tibia; at the elbow, above the inner condyle. When the body has been coaxed into the best possible place, a curved needle or a tenaculum is to be inserted into it on the side towards the joint; and the tenotome, passed in some distance from its opposite extremity, is to incise the synovial membrane as far from the juncture of the bones as possible. The opening is not to be too extensive, but sufficiently large to allow the body to be squeezed through it and away from the insertion of the tenaculum. After completion of the operation, the limb is to be put slightly bent upon a splint.[1] If there be more than one body, they are all to be brought if possible to the same part of the sac.[2]

The second operation is not always necessary, for the body may diminish rapidly in its new place, and cease to give any trouble; when it is necessary, the proceeding is excessively simple, consisting only in cutting directly down upon the body and taking it out. It is well to let a number of days elapse, so as to be quite sure that the wound in the synovial sac has healed.

Eight years ago, Mr. Syme published A New Method of Treating False Bodies in Joints,[3] which apparently consists in all the same steps as the first operation above described, except that the body is not squeezed out of the sac, but is retained by bandages to contract adhesions; but it is rather difficult to see wherein the advantage may lie.

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[1] The elbow is to be bent at right angles.

[2] Mr. Syme affirms that he hit upon this plan at the same time as M. Goyrand, but the account of his procedure did not appear till long after M. Goyrand's cases were published in 1841.

[3] Edinburgh Medical Journal, Nov. 1852.

ON DISEASES COMMENCING IN THE BONE.

CHAPTER X.

ACUTE ARTICULAR OSTEITIS.

THE diseases of joints hitherto examined commence in the soft parts, that is, in the synovial membrane and the subsynovial tissue; another set of these maladies begins in the bones. Like those already described, these all originate in inflammation: and osteitis, or inflammation of bone, is a disease that has been known from time immemorial. But in the present instance, as I wish to designate those osseous inflammations, which, being situated close to a joint, affect the integrity of that mechanism, I have taken the liberty of naming the particular malady to be considered Articular Osteitis, that is, inflammation of a joint-bone.

The heading of this chapter may be remarked as singular in another way, since neither Stanley, our great English authority on bone diseases, nor Paget, nor systematic writers on surgery, have separated osteitis into the acute and chronic divisions, as they have done with other inflammations.[1] There is, however, doubtless a wide line to be drawn between different degrees of rapidity in bone inflammation, and if the distinction be worth anything in other tissues, so is it worth at least as much in this. The most chronic form of osteitis is probably the slowest of all diseases, while a highly acute species of the malady has lately been described by Klose as occurring in joint ends, and occasionally spreading to the shafts of bone, which is really as acute an action as most with which we have to do. Whether the disease occur in one situation or the other, it is founded in a very cachectic condition of system; it is rare, and in the shaft is generally the result of accident, as of a compound fracture exposing a large portion of bone, or deep laceration laying that tissue bare. But any osteitis, even the most chronic, may put on more rapid, and at last highly acute symptoms, which shall end in death of the bone and plentiful suppuration, with some destruction of the periosteum, ulceration and suppuration of the surrounding parts, &c.[1] The whole course of the disease is generally completed in from a week to a fortnight, ending, if the bone have been small, usually in its death, and separation by the surgeon; if large and deep, in purulent absorption, and death of the patient. The frequent necrosis of the last phalanx from neglected whitlow, with redness and phlegmonous inflammation of the finger, is a good example of the former and slighter occurrence. But when this malady attacks a larger and deeper bone, its symptoms are very severe, whether it be the result of accident or of a great chill happening in a debilitated constitution. The disease is ushered in by very severe rigors, great pain in the back, and the other prodroma of all violent febrile attacks; soon afterwards there arise great rapidity of pulse, heat and dryness of skin, a dry and coated condition of tongue, anxious expression and sleeplessness. The affected bone, whichever it may be, is the seat of intense pain, and of a swelling which is always hard, and in deep bones is also deep seated; the skin itself is red, except when the bone be very deep, and at all events is very hot; when the osteitis is extensive the pain is so severe that it quite exhausts the patient, and renders him comatose or semi-comatose. Low muttering delirium appears very early in the disease; the tongue is dry, brown, swollen and cracked. The affected limb is held immovable; indeed, the patient avoids all motion for fear of disturbing the part; very soon the swelling becomes softer, shows evidence of suppuration, and, except when very deep seated, as at the femur, fluctuates. At last intense coma comes on, the patient sinks and dies. On examination of the limb, the bone will be found lying loose in a quantity of pus, which fills the periosteum; it is of a dirty-yellow or gray color, and has a very bad odor; its surface is rough and crumbles. The periosteum is softened, the attachments of the muscles have separated, and the inter-muscular spaces are infiltrated with a blood-stained serum or a thin ichor, which discolors the muscular tissue. The internal organs show, according to Stromeyer, signs of purulent infection, the lungs and liver being studded with secondary deposits.

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[1] American authors, e.g. Gross ("System of Surgery") make no such distinction, neither do I find such in the "Compendium de Chirurgie Pratique," by Denon, Villiers, and Gosselin. German authors, however (see Wernher, and also Angelstein's "Handbuch der Chirurgie"), have perceived as much difference in the rapidity of inflammations of the bone as of any other tissue, and have made two classes—acute and chronic. While Stromeyer, in his "Handbook of Surgery," separates them into peracute, acute, and chronic.

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[1] It is only due to Stromeyer that the following extract should be appended: "These conditions are evidently connected with purulent phlegmonous erysipelas, which arises from similar causes, and with which peracute osteitis has, even in outward appearances, the greatest similarity if it have its seat in a superficial bone, for instance, in the front of the tibia. Unhappily, indeed, on this account, acute inflammation of that bone is usually mistaken for erysipelas, until the practitioner finds by the exposure and death of the bone that he has to do with an osteitis. In traumatic erysipelas, after amputation, the great projection of the bone is evidently due to a highly acute osteitis, the periosteum and the insertions of muscles have all separated from the bone, and yet, strangely enough, an inflammation of this structure has never been thought of." "Handbuch der Chirurgie," 1er Band, 3te Lieferung, p. 418.

In my own practice only one case of such extreme severity has occurred.

CASE XLIX.—John Murphy, aged 63, came to me at the Charing-Cross Hospital, August, 1858, having met with an injury to the middle and fore fingers of the left hand, they having been crushed between pieces of machinery. The forefinger had sustained a simple fracture of the first phalanx; the middle finger was crushed and much lacerated; the metacarpo-phalangeal joint was torn open; the proximal end of the phalanx was fractured and thrust through the skin at the inner side, and the end of the metacarpal bone was broken and partly protruded through the wound. The accident had occurred two hours before; the man had fainted, and he had been taken to a druggist and had some medicine (restorative) and brandy administered; he then went home, and subsequently came with his son to this hospital; neither of the two men were quite sober. He utterly refused to come in. I explained to him and his son the necessity of removing the crushed finger, to which he consented, and they promised to return the next day, or at least that the son should come to me.

The operation was extremely simple, since, by nipping off the end of the exposed metacarpal bone, sufficient sound integument could be procured to cover the rest.

For ten days I heard nothing of this patient, nor did I know where he lived; on the 10th day his son came to say that his father was very bad. I went at once; the poor man had been utterly neglected; the whole hand, arm, shoulder, and chest were red and swollen; the bandage on the hand, which had never been removed, was so tight as to cut deeply into the flesh; bullæ had formed in various parts. The lips of the wound had partly ulcerated away, partly retracted, so that a portion of the metacarpal bone was visible, which was black, or rather ash-gray. The man could only with difficulty be aroused; the tongue was dark brown, in places black; it was dry and very much coated; the pulse quick and thready; he had diarrhœa.

The case seemed hopeless, but it appeared right to do all that could be done. I made a deep incision along the back of the ulna and another in the upper arm; he hardly seemed aware of what was done; very little blood, but a good deal of reddish serum and thin pus flowed. He was ordered ammonia, opium, brandy, and I was able to procure for him some strong beef-tea. However, all was, as might be expected, useless; he was *comatose* when I saw him the next morning, and died a little after noon.

With great difficulty I procured permission to examine the limb, but not any other part of the body. All the tissues of the hand were infiltrated with reddish serum, and beneath the palmar fascia was a large collection of pus; the muscles were softened. On passing my finger into the wound that I had made during life over the ulna, I could feel the bone bare, and enlarged the incision along the whole length of the arm; some red serum and a large quantity of thin pus and ichor flowed out; the bone was quite loose and rough, its lower end could easily be taken out of the wound, but the upper remained attached to the humerus; all that part which was removed was of an ashen-gray color, rough, and in parts crumbly and quite bare of periosteum, which was left behind as a suppurating bag. I passed my finger into the wound and found that the lower end of the humerus, and all, or a great deal of the radius, were rough. I detached the ulna from the humerus and found both bones rough, and the former devoid of cartilage, the latter having very little still remaining; all the soft parts were infiltrated with putrescent pus and blood-stained serum. Further than this I could not push my examination, on account of the impatience and jealousy of his son, who insisted on remaining in the room. The humerus did not seem affected beyond its lower end, but there was the same intermuscular infiltration with pus and serum both in the upper and fore arm.

Osteitis of such extreme severity does not limit itself strictly either to joint end or to shaft, but oversteps the boundary which a milder disease observes. If then such an affection pass to the joint end of the bone, it follows necessarily that the articulation will become involved, but the intensity of the whole set of symptoms is so great, that it in a measure masks the especial signs of the joint disease. Upon the ulna, which I examined, no cartilage was left, and but very little on the humerus, the synovial membrane was suppurating, but during the short time that I had an opportunity of seeing him during life the joint itself attracted no attention; in that case the disease was, when I saw it, so far advanced, that no especial point of the arm could be hit upon as more affected than another. But sometimes the epiphysal end of the bone, and its neighboring joint, may become the seat of a similar inflammation. The cases must, however, be rare; I have neither seen one, nor have found the description of one, in any English work; but Stromeyer gives an account of *Osteitis articularis peracuta* or *Arthrophlogosis totalis,* and Klose has seen and described thirteen cases, with slightly different features, naming them also in different manner. Stromeyer says: "After violent rigors supervene pains in the joints, so severe as entirely to prostrate the patient. The pulse is small and extraordinarily quick, the tongue dry and brown, the appetite is entirely lost, and thirst extreme. The joint swells, fluctuates, and the fluctuation extends beyond the limits of the synovial membrane. The limb becomes œdematous, and an erysipelatous redness of the skin appears; sometimes gas is developed by the disorganized and putrid flesh and exudations; generally, before it bursts externally, the patient dies, either from the accompanying disease, for instance pericarditis, or from the reaction of the putrid pus upon the system. Only in very rare cases can the patient recover. When the parts burst the pus is discharged, and the sloughs together with the joint ends of the bone come away.

"Happily these frightful cases are rare, but not to such a degree as to merit entire neglect in systematic works on surgery.

"Sometimes, as I have frequently seen, this process attacks a joint that has suffered for years from chronic inflammation, and in which some new unfavorable cause—a blow, a fall, or a severe chill—has set up an inflammation that soon brings the part to a destructive termination.

"On anatomical examination, the capsule of the joint will be found destroyed; the soft parts in the neighborhood gangrenous; the ligaments, muscles, and cartilages have all detached from the bone, and the large cavity thus left is filled with brown putrid pus."[1]

The thirteen cases which Dr. Klose saw, and which he describes,[2] all occurred within eight years, in the epiphyses of young persons; hence he names the disease, somewhat inaptly: "Separation of the Epiphysis" (Epiphysentrennung), or, *Meningo-Osteo-phlebitis.* They were thus distributed: one in the humerus, at the elbow; one in the ulna, at the elbow; four in the tibia (three in its upper, one in the lower epiphysis); and seven cases in the femur, at the knee; showing that the knee-joint is by far the most exposed to this disease, since, of the thirteen cases, ten occurred in that situation. The attack never arises independently, but commences during the course of some other malady. "This disease," says Dr. Klose, "is always preceded by an inflammation which is situated in the cancellous cavities, and thence spreads over the epiphysis, the periosteum, and a considerable part of the shaft of the bone. If the bone be that of a limb possessing but one, in which case it is covered by a thick mass of muscles, the disease will owe its origin less to traumatic than to rheumatic causes;[1] if, on the contrary, the bone be nearer to the surface, traumatic cases will predominate." Among the outward signs of the commencement of this disease, when it is of rheumatic nature, is a severe pain near the joint of the limb affected. The patient cannot use that limb, and is seized with a severe rigor, which is followed by continued heat and great fever. In a few days considerable enlargement comes on, accompanied by acute œdema in the course of the diaphysis, and the neighboring joint, which is hot and tense, but not hard; there is no trace of redness on the skin, but a gray earthy discoloration on the surface over the extent of the disease. The patient endeavors to keep the limb semiflexed, because in that position he suffers least. The prognosis is favorable, as long as the tenseness of the skin is uniform; less so when, below the surface, cord-like indurations run through the swelling, or when inflammation of the lymphatics or of the deep veins be added. If an acupuncture needle be plunged in a direction towards the bone into the swelling, and it be attempted to move it in circular sweeps, an equable resistance will be found as long as it remains in the soft parts; but if it be passed to the bone, and then drawn a little (about a line) back, it may be turned in any direction. The bone itself will be felt to be rough. There can then be no doubt that the swelling of the limb depends upon solid exudation in the soft parts; but under the periosteum, which is lifted away from the bone, a fluid is poured out which makes the bone surface rough and uneven, because it has destroyed its enamelled surface. If the origin have been rheumatic all these symptoms will have been very quickly developed, and will be accompanied by active inflammatory redness, with rapidly spreading phlegmonous inflammation and suppuration, and sometimes even gangrenous destruction of the skin. The patient is pale, the albuginea of the eye yellowish, the conjunctiva anemic, the nose dry, tongue white, covered with a thick fur, thirst considerable, respiration quick, pulse rapid, small, and sharp. The upper part of the belly is tense and rather tender on pressure, the lower part, slightly protuberant on account of a little tympanitis, is however in no way tender, the spleen is rather enlarged, the bowels are confined, the urine is scant and red. The œdema being acute does not produce pitting, but pressure with the finger leaves a light yellow tinge behind. By passing a small exploring trocar and canula through the swelling, to the bone, withdrawing the former while the latter is pressed home, one may be sure that the end of the tube (by its mobility, as above indicated) is between the periosteum and bone. A suction syringe applied to the free end will furnish evidence of the existence of exudation, viz., of pus and ichor, under the periosteum. Now as long as this material remains in that situation, so long will it increase by its irritation the serous exudation in the soft parts; but when the fibrous membrane breaks, and the ill-conditioned matter is discharged into the surrounding parts, then another stage begins.

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[1] Handbuch der Chirurgie, 1er Band, S. 477.

[2] Prager-Viertel-Jahrschrift, Jan. 1860, S. 97.

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[1] Among rheumatic causes Dr. Kloss includes, probably, severe chill.

The second stage consists in the suppuration of all the parts included beneath the fascia, in phlebitis with obstruction of the veins, in the gradual involvement of the periosteum, and ultimately of the whole diaphysis, which leads to the last condition.

Third stage, or separation of epiphyses from the shaft, may be easily diagnosed by the change in form and position, and by the abnormal mobility. At last the truncated end of the femur, pressing outward more and more, penetrates the skin. If loss of power, discharge of ichor, and commencing purulent infection have not caused death in the second stage, so will all the above events happen; neither the suppurating condition in the second period permits amputation, nor can we hope anything from resection of the necrotic end of the femur in the third.

Nothing is beneficial, unless a free incision be made down to the bone; it is the only hope, and all delay diminishes the chance of life: if the bone be found white and of a normal hue the patient will do well; if on the other hand it be spotted with brown or black spots, or if it be throughout of a dark gray color, the incision has been too long delayed, and the only hope is to watch and seize a favorable opportunity for amputation above the seat of disease; but even after that procedure, purulent infection is the too frequent termination of the case.

"*Local autopsy.*[1]—The anatomical examination of individuals, who have died of this disease, has always yielded the same results. If the patient have died in the second stage, the lower end of the femur will, on cutting through the soft parts, be found in a roomy cavity, bare of periosteum and dark in color. The bone is surrounded by pus, which has an ichor-like quality. At the point of junction between diaphysis and epiphysis, the former is spongy, soft, and soaked in pus; the line of union is marked by a more or less deep groove, and here the division between the bones will occur. The longer this stage has continued, the more is the end of the diaphysis softened and the deeper is the groove round it. The muscles lie in the ichor, isolated, and their sheaths are destroyed. Their color is dark brown, and their surface is clothed with dirty brown or blackish little clots of blood and pus, which form as it were a continuous covering for them. In the latter end of this period, when the purulent infiltration has reached half way up the femur, the muscles are found hard and ribbon like, and if they be cut through the middle the surface of the section will be discovered dark brown and glistening, the fibres compressed, and the muscle itself is hard to the touch. The larger as well as the smaller veins are obliterated, and throughout their whole course are filled with hard coagula. The walls of the abscess are darkened by the ends of small venous branches with open mouths, out of which plugs of coagulated blood project into the space. The cavity is filled with pus, and masses of coagulated venous blood, sometimes in larger, sometimes in smaller lumps, according to the more or less advanced condition of the case. In this second stage the knee joint is still uninjured. There is some serous collection in its cavity, the edge of an incision into it oozes a little with serum, and a few fibrous exudations are also to be seen; the cartilaginous covering of the femur is of a dull white, here and there spotted dark. In the third stage, the inner and upper part of the sac is more particularly involved, pus has broken into the joint and produced much destruction; partly in the ligaments, partly in the cartilaginous covering of the condyles. In places this is destroyed, the bared condyle looks gray, is soft and spongy. Commonly each condyle is separated from its fellow, so that not only does the synovial membrane form, with the abscess, one common cavity, but the two condyles separated from each other and the shaft are found lying free in the bag. If the whole length of the femur be taken out, it will be found to be in the second stage, necrotic only as far as the abscess in the soft parts had reached. In the third stage, on the contrary, it is necrotic almost throughout to the trochanter. Its surface is grayish black, its external table (tabula vitrea) eaten away and rough; the parts still smooth are covered with thready remains of the periosteum, and in some places with little osteophytes which give the surface an uneven appearance. If the bone be sawn through in a fresh state, it presents inside the medullary cavity a dark red appearance, its interstitial tissue is soaked in a brown red, gray or gray-brown-red (graubraun röthlichen) exudation, according to the stage of the inflammation. If the cavity be, however, still full of medulla, this material will be studded with a quantity of dark red spots (apoplectic clots), which will be found, according to their age, in a more or less complete state of putrescent suppuration. Indeed, the whole internal parts of the bone present the appearance of a widely diffused phlebitis, with transitions into exudation and suppuration."[1]

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[1] This account refers particularly to the lower femoral epiphysis.

The paper from which the above abridgments and extracts are taken has not excited in England as much attention as it deserves. In France, an abstract of the thesis was published in the *Archives Générales de Médecine* for August, 1858, and in the November number of the same journal, M. Gosselin points out that the disease thus described is identical with Chassaignac's Osteo-myelitis, but occurs in younger persons, and is situated in the epiphysis; he then divides the bony inflammations in a way that appears to be unscientific, and terms the disease which Klose has described, *Ostéite épiphysaire aigue suppurée.* Three cases, two of which only appear to belong strictly to the class of cases described by Klose, show that a similar malady is known in the West of Europe.

It has not been my fortune to see any disease at all similar, nor can I find any account in English medical journals which would lead me to believe that such has occurred in this country. Therefore it is apparently better to give these observations of a most destructive and happily rare form of joint disease without further comment.

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[1] Op. cit., p. 114 et seq.

CHAPTER XI.

STRUMOUS ARTICULAR OSTEITIS.

PATHOLOGY.

OSTEITIS may be produced by other constitutional taints besides scrofula—syphilis, for instance, and rheumatism. It is, however, rare for syphilis to attack the spongy end of a long bone; it affects in preference the harder portions, commencing on the surface. Of the rheumatic disease, as it appears in the joint ends of bones, we shall speak in another chapter.

Strumous inflammation of bone has a great tendency to affect the cancellous structure; it is apt to attack the irregular bones of the carpus and tarsus, also the ends of long bones; in this latter situation, it is almost exclusively a disease of childhood, or of the age before puberty: affecting a bone throughout cancellous, as those of the carpus or tarsus, it is, I believe, nearly as prevalent in adult life. The inflammation generally commences in the interior of the spongy structure, but may also begin in the cortex and periosteum. These latter modes of beginning are more characteristic of the syphilitic and rheumatic form, and are very rare in primary strumous osteitis. Another mode of commencement, approaching a slower form of the disease described in the last chapter, is that the whole epiphysis may become involved. Occasionally in those long bones, as the metacarpal and metatarsal, which have an epiphysis only at one extremity, the shaft and the non-epiphysal end are simultaneously attacked. In early life, the entire separation, vascular, nervous, and indeed histological, between the diaphysis and epiphysis, sunders the diseases of either from those of the other as much as though they occurred in different parts. It may also be observed that the joint ends of the bones are in this stage of life undergoing ossification, and it is the increased nutrient excitement attending that act which makes osteitis so prevalent in early life.

The first appearance of the disease (speaking of makroscopic anatomy) is hyperæmia: this is much more marked in a spongy bone than it can ever become in inflammation of dense osseous tissue; it may at first affect only one, or perhaps two or three spots, in the bone; or it may be more widely spread, and attack the whole spongy texture. It is, however, to be remembered, that hyperæmia is neither inflammation, nor an infallible sign of that condition, and we must not, in making pathological observations on the epiphyses of young children, imagine that every congested joint-end is inflamed, or will necessarily become inflamed. It has once or twice happened to me to find in the same subject nearly all the larger epiphyses hyperæmic, and I believe that we could look into the bones of very few children between the ages of two and ten, without finding some such congestive state; yet how comparatively rare is inflammation of a joint-end! The truth is, that the nutritive activity brought about by the ossifying action in the epiphysis, is very apt indeed to produce a congested condition of the part; and the large bone-ends which are found in strumous children are the accompaniment of such tendency to congestion. As the child gets older and stronger, this hyperæmia disappears, and in the great majority of instances is followed by no evil results whatever. It is, however, certain, that in a given number of cases, the congestion predisposes to inflammation, and the merely passive is followed by an active condition. Thus inflammation may be set up in an epiphysal end, which was previously in an abnormal state, and such, in the greater number of cases, is the mode in which the disease now under consideration commences. All such attacks are in the beginning very slow, and hang for months, perhaps even years, between a state merely of sluggish functional performance and of active disease. It happens, however, sometimes, that inflammation of a joint-end commences at a later age, when the ossific process has entirely ceased, and when all congestion owing to that cause shall have terminated; such cases are more rapid in their progress, produce a somewhat different set of symptoms, end more frequently than the other form in necrosis of some of the cancellous parts of the bone, and the joint itself does not necessarily become involved. The seat of the hyperæmia, whether merely congestive or inflammatory, is not the bony structure itself, but the membranous lining of the cancelli, which, in health, is pink and vascular. The bony lamellæ which surround the cancellous cavities are very slightly supplied with Haversian canals (see Chapter I., p. 22); hence hyperæmia of the osseous plates themselves can hardly reach such a point as to produce increased redness. The congestion is to be seen by sawing through the bone, when it will be found to impart to the surface of the section a hue varying from a mere flush to a purple color. This hue extends in some instances (the most cachectic) equably over the whole section; in others it is chiefly marked in certain spots; each such spot being surrounded partly or entirely by lighter-colored portions. Such arrangement gives to the section-surface a marbled or mottled look, not easily forgotten when once seen. The appearances may be merely signs of that congestion so prevalent in young children; but actual inflammation is marked by some other signs—either by thickening of the osseous tissue, or by effusion of a pinkish serum. The former stands on the boundary line between increased nutrition and inflammation, the latter is the result of a stasis whose occurrence plainly marks the transition from the one process to the other. Thus, if on sawing through a spongy bone taken from the dead subject we find only redness, we may set down the abnormal vascularity as merely passive congestion; but if there be thickening, that is, if the plates of the cancelli are increased in thickness and their cavities diminished, still more if the reddened portions be soaked in a pinkish blood-stained serum, we may assert that the bone is inflamed.

This thickening of the bony lamellæ is an action analogous to, or rather identical with the increase in any structure subject to irritation; it is like the thickening of the cellular tissue under slight and remittent pressure; like the thickening of tendinous sheaths, or of fasciæ under many circumstances of extraordinary use, and therefore of nutrient irritation. It is also the mildest, and generally the incipient, stage of inflammation; hence in soft parts, when an areolar tissue is attacked by inflammation, it first hardens; then, in the centre of the hardened mass, suppurates; this latter action spreads, and perhaps soon involves the whole of the previously indurated mass; but as it does so, the inflammation also enlarges its area, and its outer circumference producing hardening, forms a boundary to the abscess, the suppurating focus being surrounded by consolidated tissue. If the constitution, however, be much broken, and cachexia far developed, the action is not of a quality good enough to produce induration: hence the abscess is diffuse—not inclosed by hardened material.[1] So also in bones we find, except in the cachectic state, the same indurating process, surrounding a suppurative one; hence that marbled appearance described above often increases, the light parts becoming lighter as they thicken, the darker parts darker as they get more and more hyperæmic, and more full of the red effusion.

The exudation of a blood-stained pinkish serum is a sequela of inflammatory stasis of a more marked and decided character: it is possible that many gradations exist between the dry superaction, whereby bones are indurated, and the plentifully moistened state which is often found when the cancelli are full of this fluid.[2] It is, however, certain that a plainly visible exudation of serum in bone is a forerunner of suppuration. A stasis which is sufficiently marked to produce such an exudation is at the same time generally sufficient to cause extravasations. Sometimes in the stronger cases these are very small, each occupying only one cancellus; sometimes they are larger, and are spread over several; forming in the one instance small speckles, in the other large blotches. The latter mark a disease which will run through a rapid and destructive course.

These actions belong to the commencement of the malady only, and for the sake of more distinct reference to the whole group, viz., passive congestion of the epiphysal ends, which becomes active hyperæmia, producing thickening and the effusion of a pink serum, we will call this the first stage of articular osteitis.

Very soon after the first appearance of this pink serum[3] the redness of the section surface will be found obscured by a thick yellow pus, which oozes from the cavities, and covers the surface of the bone, which, even when that surface is wiped clean, still remains in the cancelli, and gives the section a dirty-yellow hue. If, however, by directing a stream of water upon the surface, this pus be washed away, the hyperæmic redness becomes again visible, but is never so pure as in the first stage, before suppuration has commenced. In those spots, where the suppurative action is going on, the cancelli will be found occupied by a red or pink gelatinous material; that is, by granulation from the lining membrane. These actions, namely, suppuration and granulation in the cancelli, are accompanied by caries, or wasting away of the osseous material. The walls of the cavities become thinner as well as softer, may ultimately disappear, and their place is taken by the granulation tissue, until at last this portion will be "a fleshy mass permeated by a thin and brittle bony network."[1] Even from those portions of suppurating bone, which are not in their totality absorbed, the earthy matter is extracted,[2] so that the tissue becomes flexible, soft, and may easily be cut with a knife, or impressed by the finger; and in some rare and very cachectic instances even the external shell is involved, so that the whole joint-end is reduced to a soft mass.

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[1] See my papers "On Strong and Weak Inflammations," Med. Times and Gazette, June, 1855 et seq.

[2] The blood-staining is probably due to the unyielding character of the tissues: at all events, a similar amount of exudation in soft parts is not colored.

[3] The processes of inflammation cannot, of course, be followed out upon one and the same bone; but they may be traced not merely upon several different subjects, but, better still, on the same subject, on different bones which are found in various stages of the disease: such occur frequently in the carpus and tarsus.

Such a result is, however, very unusual: when it occurs it is called *caries diffusa totalis.* The more usual event is, that induration accompanies and surrounds the ulceration, *caries circumscripta;* and sometimes both processes go so far that all the bone in the centre is replaced by pus, which forms an abscess, surrounded by indurated tissue—such cases are almost confined to adults. When caries of an epiphysal end is taking place, it begins generally by one or more spots of suppuration about the centre, more or less surrounded and separated from one another by thickening; the action gradually spreads, the hardening process also enlarges its area, until all the different points of suppuration come together, while the indurating process reaches the outer shell of the bone and the periosteum, which latter inflames, swells, and constantly deposits new and new layers of osseous matter, while the older ones are wasting from within. By these processes the cancelli increase in size, partly by thinning, partly by absorption, of their walls, two or more cavities being thus laid into one, whereby the bone, growing in circumference, acquires the appearance of being *soufflé,* or distended. Stanley, in his work on the diseases of bones, has described this condition as "Enlargement of the Bone by Expansion of its Tissue;" but if we consider the mechanism of cancellous structure and the relative position of the lamellæ, we shall perceive that for a bone thus to enlarge by true expansion, each cancellous wall would have to grow longer—an action which reflection will show to be incompatible with the conditions of caries. Probably, however, Mr. Stanley intends to designate the appearance produced by, rather than the means employed for, this change in bone.

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[1] Rokitansky, "Handbuch der Pathologischen Anatomie," 3te auflage, s. 103.

[2] Here and there, in small spots, the animal parts are absorbed, and the earthy matters left as little friable cretaceous lumps soaked in pus.

Necrosis is the result of a more rapid inflammatory act—it may follow induration, or it may supervene in a bone already in part carious. It may be total, partial, or central. The first means, of course, that the whole thickness of the bone is implicated; the second, that a portion only is involved, and that some part of the dead piece is on the surface; the last, that the necrotic fragment is entirely surrounded by living osseous matter. Sometimes small but sensible pieces scattered among a suppurating bone necrose and come away—this is called *caries necrotica;* but when only one or two large masses die, and are surrounded and separated from the rest by an ulceration, this latter action is rightly regarded only as a result of the necrosis, and is not considered in the name of the disease. The indurated, the carious, and the necrotic processes may be mingled together in the same spongy end, in all proportions, there being an indefinite number of gradations between total necrosis and necrotic caries; and, again, between diffuse or entirely circumscribed caries and an induration ulcerating merely from the surface.

Tuberculous deposit in bone is, I believe, very rare; when it does occur it is a result, and not a cause, of Osteitis. Dr. Cornelius Black[1] has published some observations on what he terms "tuberculous bone;" but he has described under that name what I believe to be the filling of the cancelli by granulations from their lining membrane, the gradual thinning of their walls, and enlargement of their cavities, with just that sort of generation of bone which we find in a not very far advanced degree of caries. There is no proof that the material which he found stuffing the cancellous cavities was tubercle. Mr. P. C. Price, in his little pamphlet on "Excision of the Knee," refuses to discuss the tuberculous or nontuberculous nature of the deposit in spongy bone; but he assumes a peculiar nature for the deposit "under the character of a morbid material which partakes more or less of the nature of struma as developed in other localities of the body." (*Loc. cit.*, p. 3.) In Chapter V. of the present work was discussed the mode in which tubercle was formed from granulation—it is unnecessary to go over exactly the same ground in the present instance. We must, however, mention the undoubted fact, that many an old and desiccated purulent deposit in bone has been mistaken for tubercle; the position in spongy bone which favors pressure, the assumption therefore of a peculiar form by the dried concretion, and the fact that such pus consists of broken-down and disintegrated cells, with granules, &c., render the distinction extremely difficult. I must confess that I could accept no case as undoubted tuberculosis of bone unless some of the deposit were in a state of crudity. It must be remembered that when we find tubercles in other organs, even though most of the material may be in the farthest advanced stage of softening, some will very nearly always be crude; but I am not aware of any observations of crude tubercle in bone.

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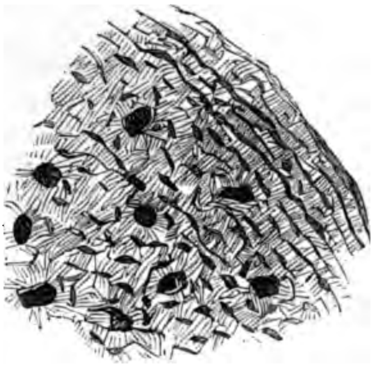
[1] "On the Pathology of Tuberculous Bone." Edin. Medical Journal, vol. iv.

The osteitis, whether it be tuberculous, indurating, suppurative, or necrotic, will at some time reach the external shell of the bone and the periosteum, producing a deposit of new osseous matter, ulceration, or death of the tissue, or all three successively. The periosteum under the first action becomes itself thicker and tougher than normal, soon a jelly-like material is formed between it and the bone, which gradually ossifies; but if the inflammation be in the next stage the effusion becomes converted into pus; the periosteum is thickened, sodden, softer than normal, and can with great ease be stripped from the osseous surface, when it does not merely drag away with it thin fibres (capillaries) that run between it and the bone, but thick sodden plugs and ridges, which, as they come out of the tissue, leave it marked by deep holes and grooves, giving it the appearance of being worm-eaten. Often a few thin, porous, softened, and perhaps discolored plates of friable bone adhere to the periosteum and come away with it. The surface being thus stripped bare, its holes and grooves are covered and partly filled with pus; its osseous texture is softened, may be cut with a knife, or perhaps may yield to pressure with the finger. If the caries be circumscribed, induration and thickening of the bone-surface take place in a more or less circular form around the focus of suppuration. The induration is of course produced by deposit of new osseous matter, but such deposition is by no means always regular; frequently erratic growths, called Osteophytes, surround and overhang the carious portion. They are by no means so large in this form of osteitis as in the rheumatic; nevertheless, they are always present, though often very small, and they frequently attack a neighboring bone; thus, I have seen an astragalus, whose texture was quite sound, except that, in the neighborhood of a carious part of the os calcis, little osteophytes sprouted thickly on its surface. These growths show the first attack of periosteal irritation, and when a caries is spreading they develop at the edge of the ulceration, then are overtaken and destroyed by that process while new ones arise further away.

The actions thus briefly described are remarkable, not only in themselves, but also on account of the similarity in their results to those of inflammation in soft parts, in which we find induration, suppuration (circumscribed or diffuse), and gangrene. In both it appears that the first effect of a tolerably healthy inflammation is to harden and condense the tissue, in which it occurs, subsequently to soften and convert it into pus. The process in bone is, however, much slower, and months may be consumed in the establishment of a small abscess, which would have formed in about as many hours in the subcutaneous areolar tissue; but this difference is by no means generic, and although there may be variation in the mere rapidity or slowness of the process the actions are alike.

It certainly is to be expected that processes which lead to the same end should in themselves be similar, and we might, *à priori*, imagine that the actions which produce induration or softening of bone should bear some resemblance to those which have the same effect on the soft parts. This subject has been with me the object of considerable care and research. In another place,[1] I published a paper upon this sub-

Fig. 12.



Section of the femur of a rabbit—normal—magnified 500 diams.

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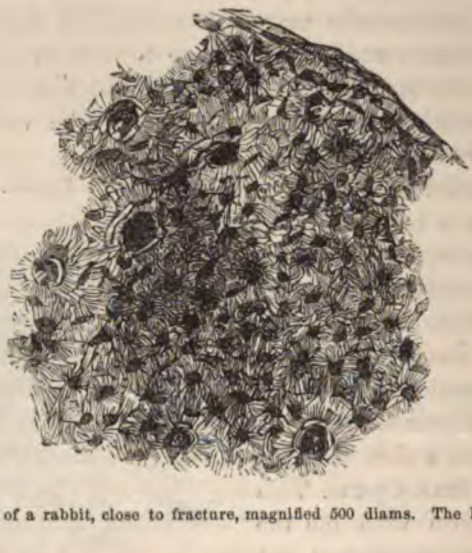
[1] British and Foreign Medico-Chirurgical Review, April, 1860, "On the Morbid Actions constituting Osteitis."

ject, whence some of the following account is taken. The first object was to obtain bone in certain different and early stages of inflammation, and for this purpose the legs of several rabbits were broken, the animals killed at certain dates from the receipt of the injury, and the condition of the osseous tissue examined. I found that the first effect of an inflammation, or perhaps one should rather say the first organic change producing an inflammation, was enlargement of the lacunæ and their canaliculi. The annexed plates represent sections of the bones of rabbits, in different states. The first is a section simply in the normal condition, the relative sizes and appearances of the parts being strictly preserved; the last is a section six days after fracture, equal care being taken in the representation.

Inflammation producing simple induration commences by some enlargement of the lacunæ; those of the Haversian systems, which, on transverse sections, appear normally long and narrow, assume under the disease an oval shape; they remain dark, except in rare instances. In the spongy texture, in which the lacunæ are ordinarily larger and more broadly oval than in the solid substance, the increase is not so marked, but is not less real. The appearance of the sections shows, therefore, an unusual crowding together of the

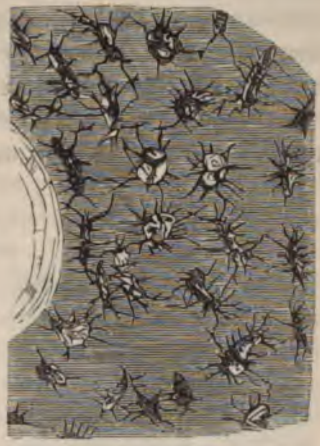
Fig. 13.



Section of femur of a rabbit, close to fracture, magnified 500 diams. The lacunæ may be seen large and round.

bone cells; but the observer will be principally struck by the increased development of the canaliculi; these channels are not only more plainly marked, but are more numerous than natural, so much so, that the bone, except for the lacunæ, assumes almost the appearance of dentine. The portion of tissue thus affected may be detected by the naked eye: if a section, simply filed tolerably smooth or rubbed on a stone without being ground thin, present any white opaque portion, the canaliculi will, in those parts, be certainly thus affected. The section looks so very nearly like human bone in the same state under less magnifying power that the same cut will suffice.

Fig. 14.

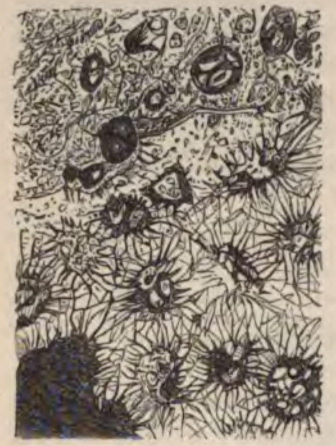


Represents a lamina taken out of the spongy portion at the upper end of a human tibia—normal. The light semicircular portion at the side represents the edge of a cancellus. The longest lacuna is 1-90th line length; the largest oval has a long diam. of 1-150th line.

Passing onwards to the focus of the inflammation, where suppuration is taking place, a further series of changes becomes apparent. The lacunæ have increased still more in size and breadth; even those of the Haversian systems are very broad ovals, or are rudely circular; their interior, instead of remaining dark, has, as it were, opened out into a light space marked by light-colored round spots, surrounded by dark lines or *vice versâ*, according to the focus and direction of the light; some of them are very granular, others, more rare, are crowded with round cell-like bodies, forming a mulberry mass, which appears to stand out above the bone surface. The canaliculi remaining, large in number, have increased in size, chiefly at their commencement in the lacuna, so that they appear to open into that space by a broad mouth like an estuary. They are throughout more marked than the normal tube; they branch also in many instances into three or four channels, and sometimes at the spot whence these branches diverge a considerable enlargement in the main trunk is perceptible, as though at that point a new lacuna were being formed.

During these changes in the appearance of the cells and their branches the intercellular substance begins to suffer a peculiar transformation, which commences first in the parts next the Haversian canal, or cancellus, as the case may be; the bony substance becomes perfectly granular, that is to say, it looks as though it were composed of dark and light-colored dots placed close together. As this change spreads from the Haversian canal or cancellus outward, the margins of the cavity lose their distinctness of outline and become very irregular; in parts the edge is gone, the cavity is therefore on that side increased; in other parts the spotted bone tissue appears to mingle, or to be continuous with some granular contents of the cavity. It is quite evident that in these places the bone tissue is softened; one can trace the gradual completion of the process from some point which is only slightly spotted to the part next the cavity, which is a mere pultaceous granular mass, in which many of the dots have the appearance of nuclei.

Fig. 15.



Represents a lamina taken out of the spongy portion of the upper end of a human tibia in a carious condition. The upper portion of the cut shows a mere pultaceous mass into which the bone has become converted, and in which dark cells from the bone are scattered. In the lacunæ many nucleated cells are frequently to be seen; one, in the lower right corner, is conspicuous for its size and appearance; it measures 1-85th line in diameter.

Another change in the cell forms part of this softening process, viz., that as the dotted or granular condition reaches a certain stage, so do the canaliculi disappear; therefore, of course, from that side first, which is turned towards the cavity (Haversian or cancellar), they vanish by simple shortening, by recession from the entirely softened bone, until they are reduced to mere little rudimentary projections on the surface of the cell. At this time the cell itself is visible as a granulated dark bag, more or less transparent, and very highly refracting, which projects from the wall of the scarcely resistant bone, and is of large size; it bulges out, and seems swollen; projects more and more, and at last breaks away from its attachment, and lies among the softened débris in the cavity, still retaining its dark color. In breaking away, however, it often leaves behind those of its canaliculi which were turned away from the cavity, and which may often be seen on the edge, but which soon disappear as softening goes on spreading outwards. Frequently several smaller cells come out of the lacuna, instead of one large one. In this way a lamina between two cancellous cavities very soon disappears from softening on both sides: in this way, also, circlet after circlet of cells around an Haversian canal cave into the cavity, and thus the system melts away and leaves around the vessel only a soft granular and cellular mass.

That portion of osseous tissue which lines within and without the shaft of a long bone, may be regarded as having the same relations in the one case to the periosteum, in the other to the medullary membrane, as the Haversian system has to the canal, or as the laminæ bear to the cancelli. The ordinary cells of this tissue have certainly this relation, but those very long cells already described as peculiar to this situation (p. 20) are not so analogous. These cells appear destined to aid quickly and uniformly in the circumferential growth, and therefore also in the internal absorption of the bone, their action under inflammation is so rapid that, unless by experiment, one has hardly any chance of detecting their agency, for as soon as disease commences at the outer layers of the bone, they begin to swell in thickness, loosening thin flakes of the structure, even before it is softened, so that in stripping off the periosteum, however gently, such pieces will (if the attack be sufficiently recent) remain adherent to the membrane. If, however, the loosened flakes be not disturbed, they soften with great rapidity, and add their quota to the thickened state of the periosteum. It was said (p. 232), that if the periosteum be stripped off a bone inflamed on the surface, "it does not merely drag away thin fibres (capillaries), but thick, sodden plugs and ridges, which, as they come out of the tissue, leave it marked by deep holes and grooves, giving it the appearance of being worm-eaten." If one or more of these plugs be examined, it will be found to consist of a vessel surrounded by a pultaceous mass of granules, among which are some scattered cells. If the worm-bitten-looking holes be studied they will each be found to represent the absence of an Haversian system, and the parts left between them the Haversian interspaces. Some of these holes run obliquely into the substance of the bone, and from these the plug is drawn out with the periosteum; others run along the new surface, and from these the ridges come; thus, it is evident that the pultaceous granular mass which surrounds the vessel is a molten and altered Haversian system. It does not always happen, however, that the whole circle is thus dissolved, and comes out with the vessel; frequently, only its inner layers are sufficiently softened to do so, and it is by no means necessary that every Haversian canal on the inflamed surface should be in the same state of advanced softening.

Necrosis presents to our consideration three conditions of osseous tissue—necrosis, caries, and induration—the two last have been described; but the relative positions in which the three occur must claim attention. When a portion of bone dies, ulceration must separate the dead mass. This action does not take place immediately on the surface of the necrosis, but a little beyond it. In soft parts the slough becomes separated by ulceration, which occurs on both sides of the demarcating line, at the edge of the sloughed portion as well as at the edge of the part to be preserved: that is to say, that a certain portion of the tissue separated is not dead, since on its surface ulceration and granulation occur. Thus, also, in osseous structure, the ulcerating action continues in still living bone on the surface of the dead material; the inter-relation of diseased parts proceeding from the healthy to the necrosed portion may be thus stated:—healthy—indurated—ulcerated—indurated—necrosed; the two last together constitute the mass separated; hence in all sequestra are two portions, the actually necrosed, and the indurated but living tissue; if the slough have occurred in the centre of a bone it is surrounded by the hardened material; if only on the surface, with death of the periosteum, the dead portion will only be lined by indurated bone on that side which was attached. On sawing through a sequestrum, and rubbing the cut surface smooth on a file or on a stone, the distinction between these two portions will be very evident; the centre, or the edge, as the case may be, will appear of a dull leaden gray, surrounded, or only lined on one side, by white and hard bone; the slough bearing, in color, the same relation to the indurated portion as a piece of note paper on which a drop of oil has fallen does to the clean white surface surrounding the spot. A section ground thin and placed under the microscope presents a similar difference of color; the light coming through the actually necrosed bone receives a dusky-yellow tinge, which is not imparted to it by the hard tissue. The transverse section presents lacunæ not at all enlarged and void of canaliculi, whose traces only appear as slight serrations of the cell's edge; the laminated lines of the Haversian systems are abnormally distinct, each canal being surrounded by circles comparative to those which in smooth water surround the spot where a stone has been thrown in. These appearances are so peculiar as at once to distinguish the necrosed portion from the rest of the sequestrum, and it is well worthy of remark, that at the edge of the slough Haversian systems are frequently to be seen, half of which are necrosed, the other half indurated. The longitudinal section also shows absence of canaliculi; a certain diminution in the size of the lacunæ, many of which, losing their distinctness of outline and hollow appearance, are filled with granules, that look like drops of oil; the laminated lines are now seen lengthwise running along the vessels.

The three changes in the bone cells, which have just been described, correspond then with the three states known as induration, caries, and necrosis; we have followed out the minute anatomy sufficiently closely, let us now consider the rationale of the process. It cannot fail to strike the attentive reader that in the first of these conditions the lacunæ and canaliculi being increased in size the actual osseous substance must be diminished, and yet the bone is condensed; a combination which, at first sight, seems impossible. But if the function of the bone cells and their branches be considered, this apparent discrepancy becomes not only reconciled, but the interdependence of the two processes will be found necessary. The lacunæ and canaliculi being the nutrient portions of the bone, it follows that their assumption of more active performance would be followed by increased nutrition of the parts they supply; hence to increased condensation of those parts;—to greater hardness of the bone. This condition has its physiological analogies, for not only is dentine more tubular than bone, but where a hard condition is necessary there do we find a more complete tubular arrangement of elements. The hardest ivory is most closely permeated by tubes. The external shell of certain crustaceæ, as the crab and lobster, becomes tubular instead of cellular in those hard tooth-like projections on the inside of the claw. In fact, this commencement of the inflammatory process is in bone, as in other parts, increased nutrition, and in its least marked form is hardly, if at all, distinguishable from the condition of growth in the bones of very young animals; it is simply a very active condition of the cells of the structure. If the inflammation subside, the lacunæ gradually resume their narrow chink-like shape, but the great plenty of long, almost straight, and strongly marked canaliculi remain—at least for a lengthened period: whether as the texture becomes more and more normal these tubes resume their usual appearance, I am not able to say. In a section through a humerus (which I took from the dissecting room and thus examined, on account of the apparent weight and density of the bone), no signs of active inflammation still present could be discovered; but the canaliculi have this intensity of development. If the nutritive activity of the cells, which constitutes an indurating inflammation, be increased to a formative action, so that they not only grow still further in size, but actually multiply within the lacunæ, then follows absorption or softening of the intercellular osseous substance to support this increased cell-growth; ultimately discharge of the cells from the lacunæ into the softened mass.[1]

The dead portion of bone, acting like a foreign body, becomes enveloped in condensed bone tissue, just as a bullet or other foreign matter, in soft parts, becomes inclosed in a fibrinous bag. Soon afterwards this tissue ulcerates in a line of demarcation in the midst of the induration, so that the slough, even when separated, remains covered in by some indurated bone tissue. The caries is accompanied by the formation of granulations and of pus from the osseous tissue itself from excessive generation of the bone-cells, in the same way as these constituents arise in inflammation of all connective tissues. When pus from bone is put under the microscope, it is seen to contain minute lime particles; moreover, my friend Mr. Tuson, Professor of Chemistry at the Charing-Cross Medical School, and of the Veterinary College, was kind enough to test for me some such matter, by mixing the pus thoroughly with distilled water, and filtering the liquor, when he found in it distinct evidence of phosphoric acid and of lime, showing that the pus contains bone material in solution.

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[1] I have deferred to the present time giving an account of Professor Virchow's views of Osteitis and his mode of investigation. He affirms that all the researches must be made upon fresh pieces of bone; that dried portions and pieces ground thin lose most signs of change; and he goes on to say: "I have either broken little lamellæ out of the inflamed portion, placed them as a whole under the microscope, and then quickly deprived them of their earthy matters by means of concentrated hydrochloric acid; or, what is often easy, have cut off thin slices with a sharp knife; or, lastly, have put pieces into concentrated hydrochloric acid, and then, from the softened mass, cut off little shreds with the scissors, or torn them off with needles." (Ueber Parenchymatöse Entzündung, Virchow's Archiv. vol. iv., h. 3, s. 304.) After this proceeding he finds that the first change is a fatty degeneration; the second is that some of the lacunæ are slightly enlarged, a few binucleated; the third is softening of the bone tissue. I have not only tried these methods of Virchow's, but have compared lamellæ taken from inflamed parts and simply mounted with others taken from the same parts and previously ground, and have failed to see in what manner grinding and polishing, if properly done, injures the specimens, while I am quite sure that the application of an acid, particularly of a strong acid, not only totally destroys all satisfactory view of that interesting portion where the bone is softening, but also greatly alters and obscures even the hardest parts. It is, however, certain that the specimen should be fresh. The process of ulceration is precisely similar, whether a portion of bone be necrosed or not; the necrosis consists in fatty degeneration of the bone-cells, which does not, I believe, take place except in, and as a cause of, that malady. I have never found it in caries proper except in a cell here and there lying among the most softened parts of the tissues. This degeneration of the cell causes loss of its nutrient power (limiting this term to the power of nourishing a surrounding district), according to the law that a cell which absorbs a special substance is only capable of self-nutrition and loses the formative power altogether, hence the canaliculi, having become useless, shrivel. I have not succeeded in accounting for the increased marking of the laminated structure.

Thus, then, in osseous tissues, we find that inflammation consists of precisely similar actions as those which constitute that abnormal state in cartilages, or in areolar membrane, namely, a superabundant growth of the cells of the tissue, which, destroying the intercellular substance, become converted into granulation or pus-cells, or may, by becoming fatty and losing quickly their nutritive powers, cause the integral death of the dependent tissues.

Inflammation of a bone will, even when it begins in the centre of the tissue, at some time involve the periosteum, and then also the soft parts in the neighborhood; there arises a hard swelling over an inflamed bone which is very characteristic, and pus may quickly form. If these actions are taking place in the immediate vicinity of a joint, it must certainly happen that the inflammation, first coming to the periarticular, subsequently affects the articular tissues; or if the primary bone inflammation be situated close to the articular facet, the disease may possibly affect first the cartilage, and then the rest of the joint tissues.

The latter mode, more fully explained, is this: the caries of the bone checks the supply of nutrient fluid to the cartilage, and the cells of that structure fall therefore into fatty degeneration; while the hyaline structure becomes first striated, subsequently studded with oil-globules, and then distinctly fibrous. The whole appearance under the microscope is different to that condition described, in Chapter V., as resulting from inflammation; in which we found, first considerable growth, and multiplication of cells inside the corpuscles, subsequent rupture of these latter, distribution of the cells into the hyaline structure, where they still continue to enlarge, multiply, and change their form in manifold ways. In fatty degeneration, the corpuscles, and the cells therein, also enlarge, but they do not multiply. The enlargement arises from accumulation of oil-globules around the nuclei in the cells, and subsequently in the corpuscle itself around the cells, and ultimately in the hyaline substance. The corpuscles occasionally burst, though less frequently, and after having attained a larger size (chiefly in the longitudinal direction) than in the inflammatory form; but the cells thus discharged are incapable of any further growth or function, they simply deliquesce, diffusing the oil around. The fibrification of the intercellular material is due in part to loss of nutrition; it always commences at the superficial aspect of the enlarged corpuscles; thence spreads in all directions, meeting on every side with similar morbid actions set up round the neighboring corpuscles. I am unable to say whether a linear arrangement of oil-globules frequently to be seen around the fatty cells, is a cause or a consequence of the splitting of the intercellular material; but am inclined to believe that this arrangement is at first a consequence of, and subsequently greatly promotes further fibrification. Those portions of the sections which are farthest advanced in this degenerative process impart to transmitted light a peculiar dull brown color. While the inflammatory ulceration nearly always commences on, or but very little beneath the free surface, fatty degeneration from osteitis begins near the attached surface of the cartilage. The peculiar dull white hue of an inflamed cartilaginous spot, its velvety consistence, and its irregular surface studded with craterlike depressions, are not marked in the ulceration from fatty degeneration with equal clearness. On the contrary, a mass of the cartilage appears sodden and swollen, and of a yellowish white; and this portion is either marked by one large ulceration with soft sodden fibres, or it will be studded by a number of smaller unequal erosions.

In other places, the cartilage over a larger or smaller bone surface will be detached from the bone itself, and only keep its place by lateral continuity with the rest of the structure. If this loosened piece be removed, and its deep surface examined, the articular lamella will be found adhering to the cartilage; in fact, it has become detached by ulceration through the cancellar walls whereby that bony plate was supported. The piece of cartilage begins to undergo the fatty degeneration, and may even ulcerate, and by degrees, unless considerable in size, disappear; but it very frequently breaks away and may be found loose in the joint upon subsequent examination.

At some indeterminate period of the osteitis, the synovial membrane of the joint becomes involved: this happens before the cartilage has greatly suffered, but its exact time and manner of implication depend upon various causes. If the bone inflammation have ended in a necrosis which lies very near the joint surface, or actually involves a portion of the articular lamella, portions of dead bone, accompanied by pus, may break into the joint cavity with more or less suddenness and produce suppurative inflammation. Such cases are fortunately not very common, and we know that osteitis affecting the spongy end of a bone is much more likely to end in caries than in necrosis; certainly in children, and even in the adult, except at the head of the tibia; in the latter event the synovial membrane receives the inflammatory impetus, but very slowly, so much so that there rarely seems any increased effusion of fluid into the joint cavity. It has been explained in Chapter I. that the free portion of the synovial membrane curling round upon the bone to reach the cartilage, lies for some little distance upon the periosteum, and that in this situation the areolar structure of the subsynovial membrane is actually in continuity with the periosteum; hence, when this latter texture inflames, the action naturally spreads to the serous tissue. The synovial membrane may therefore become affected through one or two ways—either from within or without: the first through the cartilages, becoming diseased and so far vitiating the secretions, that the inner surface of the membrane is irritated; or from gradual dissemination of the action from the periosteal to the periarticular tissues. In either case, the joint is in the following condition. One of the bones is ulcerating, and the cartilage upon it has become eroded; it is sodden, and in parts detached from the osseous tissue. The other bone and its cartilage are healthy, or at least in a state not far removed from health. Now, all natural processes tend, even in disease, to cure, although the means are often inadequate, blind, and frustrated by irritability, debility, &c. The tendency of the processes, which nature sets up as soon as the inflammation has reached a certain point, is to obliterate the joint cavity, by causing all its constituents to grow together. This could not happen as long as one bone surface was laid bare, and the other was covered with cartilage. The synovial membrane, becoming inflamed, carries the action across to the parts hitherto sound, the cartilage inflames and ulcerates on the bone as yet healthy, laying it also bare. It is singular that pathologists have not fixed upon this peculiarity of osteitic joint disease, which, commencing in one bone, attacks the cartilage in its own manner, from the deep surface, while, since the disease spreads by the synovial membrane to the other cartilage, that structure will be affected after the manner of a synovitis from its free surface. Thus the bone not affected is put into a position to produce new organizable tissue, and if the actions be sufficiently healthy to form anchylosis with its opposite fellow, which had been primarily diseased; but many things prevent this, and instead of formation of new tissue, more and more destruction of the old will often take place.

One of the circumstances in this disease, which is most remarkable, and which has the greatest effect upon its subsequent course, is its constant accompaniment—the spasmodic contraction of muscles. We have seen that when a synovitis advances so far that the cartilage becomes ulcerated, and the bone cancelli laid open to the joint, there come on certain sharp pains called "starting pains" by most sufferers, which occur at night, just as sleep commences, and deprive the patient of rest. Now a very similar but a more violent set of spasmodic pains come on much earlier in articular osteitis. It must be remembered that the innervation of large joints is derived from sensory filaments of muscular branches, and that a close connection exists in health between muscular action and articular pressure (see Chap. I. p. 40). The anatomist's knife can, with the greatest ease, discover which nervous branch sends a twig to the articulation, but when the twig has passed into the joint it is hardly possible to trace the actual spot of its distribution. Pathology, however, shows us that in a synovitic disease no especial action is produced among the muscles of the limb, until the bone underlying the cartilage becomes affected; and again, we see when that portion of bone is primarily diseased that these spasms of the muscles producing the start and the shock are among the earliest symptoms; we find that a carious state of this portion of bone is extremely irritating, and sets up not merely temporary spasms, which pass like electric shocks over the limb, but that a slower and a lasting contraction takes place. This phenomenon more or less affects all the muscles moving the lower bone of the diseased joint, but it predominates in the flexors, and therefore that bone becomes rigidly bent upon the other, the muscles feeling tight and cordlike under the skin. Such contraction is produced by a morbid form of reflex action carried from the nerves supplying the joint to those of the muscles.

There is a close correspondence between the amount of pain and these peculiar spasms; so much so that there evidently is between the two some connection of cause and effect.[1] It is generally considered that the spasms, both momentary and constant, are produced by a semi-voluntary flinching from the pain, and that the attitude is assumed for the sake of ease. This, however, is proved not to be the case: Firstly, because the spasmodic starts are by far more violent when the will is withdrawn and sensation dulled during sleep. Secondly, because cases occur in which the starting precedes any other painful symptom. Thirdly, because the constant contraction is of greater power and of longer duration than any voluntary action could be, and it continues during sleep. Fourthly, because the muscles affected with this peculiar contraction waste more rapidly than in any other disease except in certain cases of irritation of the spinal cord producing spasmodic muscular contraction. The pains of the joint are therefore otherwise connected with this spasm, and we find on examination that, although the muscular phenomena are originally produced by the irritation of the joint disease, they eventually much increase, or altogether support its morbid actions by forcing one tender bone surface against the other.[2]

Now the actions thus fully described, viz., suppuration in the bone with degeneration, ulceration, or detachment of the articular cartilage, granulation of the synovial membrane and partial or total conversion of its secretion into pus, spasmodic startings and contractions of the muscles form the second stage of the disease. During, and at an indefinite period of its progress, abscesses form in the soft parts around the diseased joint, and burst outwardly. This condition is that which I would take as the boundary mark between the second and third stage; it is not very sharp nor defined; such abscesses are extremely slow, and remain in a state near pointing for a long time; hence not the absolute bursting forms the line of division, but the first undoubted establishment of external abscess. Few cases run into the second stage without passing also into the third, and suffering some suppuration of soft parts; but both stages may be mild, and the third hardly developed, amounting only to the breaking of one or two small abscesses before the patient recovers. On the other hand the suppuration may be very extensive, abscess forming and bursting, first near the joint, leaving sinuses crowned by red pouting granulations; subsequently they are produced further and further from the articulation, among the deep muscles of the limb, these also bursting and leaving sinuses. The discharge from the sinuses near the joint, and communicating with the caries, is thin and irritating. Everywhere it is plentiful and exhausting; the patient suffers from hectic, has night-sweats, gets thinner and thinner, and, unless artificial or natural cause bring some help, must soon become a victim to the disease.

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[1] It is hardly wise to make a very minute division of different sorts of pain occurring in the same part of the same person, but there is no doubt that there are three distinct pains in the joint itself; dull aching, and gnawing with heat; the electric-like pains of spasms; and the pain on any attempt at motion, and particularly at extension.

[2] Sometimes, but at a later stage, when tonic contraction of the muscles produces dislocation, the spasms and starts abate very much indeed, or disappear altogether; the displacement of one bone surface from the other, giving instant relief; a proof, in aid of the fact, that it is this mutual pressure which produces that whole train of symptoms.

Some curious deposits of serum between the bone and periosteum take place occasionally before external suppuration has commenced. I know of no means of distinguishing these from abscess, except a grooved needle or exploratory trocar be used; they usually disappear and are not necessarily followed by suppuration. It is at this stage of the disease when the soft parts are a good deal destroyed, the ligaments softened, and the joint-surfaces altered, that dislocation most readily occurs; it happens as a rule more frequently in those joints in which the bones do not closely embrace each other, but lie merely in apposition; thus the ulna is very rarely, if ever, spontaneously dislocated from the humerus, the radius more frequently; and the tibia is not uncommonly drawn backward from the femur.[1] Dislocation occurring thus when the patient is almost in the very grip of death, produces a wonderful change; the pain, the starting, &c., all relax, from that moment the disease mends, and the patient probably recovers, if recovery it can be called, with a distorted and generally a useless limb.

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[1] The hip-joint appears to form an exception to this rule, but in fact spontaneous dislocation of that joint is far less common than is generally supposed.

Occasionally, though rarely without the production of a dislocation, an amendment sets in, and the action, instead of continuing to be destructive, becomes reparative. The bone cancelli become filled with healthy fibrating granulations, the synovial membrane also converts its gelatinous growth into good solid fibrous tissue, the parts grow into, and contract upon, the cavity, until it be obliterated; then discharge ceases, the abscesses fill up, and from this point anchylosis is merely a matter of time.

SYMPTOMS.

We have seen that strumous inflammation of the joint-end of a long bone is rare in the adult and common in the young subject. Hence, when a grown person is found affected with osteitis in such a part, it is generally traceable to some other cause—rheumatism, syphilis, or injury. Yet it occasionally happens that such disease does occur in grown persons, but then it is more rapid, and ends rather in necrosis than in caries, and is almost confined to the head of the tibia, though it does occasionally attack the femoral condyles; a scrofulous inflammation of bone is among adults more common in the short, irregular, spongy bones of the carpus or tarsus, but in children nothing is more common than inflammation of the epiphysal ends of the bones.

The first sign of an osteitis commencing as a chronic disease is a dull aching pain in the part, generally increasing at night. When it occurs at so early an age that the patient is not able to give an account of its sufferings, the nurse or mother will first observe that the child cries when, during washing or dressing, the affected limb is moved; and when once attention has been thus directed to the part, it will very soon be found that the child avoids using that limb as much as possible. Such symptoms, when they have for a day or two been sufficiently constant to be undoubted, should never be neglected, but the sufferer should be subjected to skilled examination.[1] The child's nurse or mother will point out to the surgeon which limb or which joint appears to her the one affected, and the movements which cause crying or flinching. He should then examine those movements, joint by joint, so moving different parts of the limb that only one joint is stirred at a time, and thus, by watching the expression of face, he will soon know in which the pain is situated. At this early stage the eye will not be able to detect any difference between the affected limb and its fellow. He should then subject the part to a careful manipulation, and should accurately compare the shape and size of every point of the bones forming the joint with those of the fellow limb: thus no alteration can escape him. The first intimation of change is not so much actual swelling; we have seen that the bone itself very rarely enlarges, or, as has been supposed, becomes distended, as by some internal force. What little swelling there may be affects the periosteum and the fibrous textures immediately around. It is at first but slight; I have seen many cases of early osteitis, in which accurate measurement, by a tightly drawn band, has shown no swelling, but in which examination by the hand could detect a subtle change in form, consisting in greater breadth of all the elevations and less depth of all the natural depressions of the part. This condition is accompanied, if the bone be quite superficial, by increased warmth, generally also by tenderness. Such symptoms, corresponding to the changes described as appertaining to the first or congestive stage of the disease, may last for weeks, even for months, and may then subside, or indeed be altogether subdued.

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[1] The reader will remember that in strumous synovitis occurring in children swelling is frequently observed before any symptoms of pain are perceptible, or

On the other hand, the malady may increase; the pain will become more severe, particularly at night, and the child awakes from sleep, partially or altogether, with a cry of pain. In this stage the heat of the part will be more marked and the swelling more perceptible; the form of the joint-end of the bone will alter, or, to speak more correctly, the periosteum and the fibrous tissues in its immediate neighborhood will become inflamed and swollen, and the tumefaction will concentrate itself more particularly at certain spots, in which the effects of the disease will be most strongly marked; thus the internal condyle of the femur will often project very much and pointedly; the enlargement is not bony, but is elastic, and at first fluctuates, although it is hard. The swelling is, in fact, produced by effusion of fluid beneath the periosteum in the

that, at least, when attention has been drawn to the part by signs of pain, swelling is at once perceived.

same way as nodes are caused, but over a much larger surface; the tightness with which the fluid is bound in between the tough fibrous membrane and the bone producing the hardness. These spots of effusion do not last long, but become dispersed and merged into the general softer and diffused swelling, which goes on increasing until it greatly alters the anatomical forms of the bones, exaggerating their processes, and covering them with a swelling more or less pulpy, yet having a hard foundation, with a sense, in points, of obscure fluctuation. This swelling does not spread over all the joint, but is confined to one of the bones that enter into its formation. At this time the skin over the part will often assume a reddish or pinkish hue.

At some indeterminate period of the bone-disease the joint will begin to suffer. In the particular cases now under consideration the synovial membrane becomes very slowly implicated by a gradual extension of the inflammation from the periosteum to the subsynovial tissue (see p. 243). At first no perceptible increase of secretion takes place into the sac of the joint, but a gradual process of soft thickening commences, which, produced by the same granulating process as an ordinary synovitis, causes a similar condition of the part. The joint becomes rounded and shapeless, but never to the same degree as in the strumous, and pulpy granulation of synovial membrane; on the contrary, the place of origin of the disease maintains its pre-eminence, and does not become so covered but that its morbid condition is to be detected till at least a very far advanced stage of the disorder. At this early period there ought to be no difficulty in distinguishing one form of joint-disease from the other—the following table gives shortly the distinguishing points:—

DIAGNOSIS BETWEEN STRUMOUS ARTICULAR OSTEITIS AND STRUMOUS SYNOVITIS IN THE EARLIER STAGES.

Strumous Articular Osteitis.	*Strumous Synovitis.*
The first symptom is heavy dull pain with limping or other imperfection in the use of the limb; this comes on before any swelling is perceptible.	The swelling is either before pain, or is discovered with the pain.
The pain is generally increased in bed, and is subject to variations: sometimes quite disappearing for a time, and again returning.	Pain being a later symptom as regards visible swellings, yet when it comes on is constant.

The swelling at first is confined to one portion of the joint, for instance, at the knee, the upper when the femur, the lower when the tibia is affected. Afterwards though the whole joint be enlarged, the tumefaction is more marked, harder and larger over the bone primarily affected, and is nearly always on one side of the joint. The division between the bones remains evident to the touch.	**The bones forming the articulation are blended by the swelling into one rounded shapeless mass, which overlies both parts of the joint equally, and conceals greatly or altogether the line of junction between the two bones. There is no preference of place; the swelling is equable over the whole joint.**
In all but the deepest placed bones the integuments over them are sensibly hotter.	**The integuments are not at all, or scarcely, increased in temperature.**

Very soon after the commencement of inflammation, as contrasted with congestion, certain symptoms supervene which mark the commencement of the second stage of the disease. Such are, peculiar aching, wandering sensations along the course of the bone whose end is diseased, combined with spasms of the muscles, producing starting pains and permanent contraction. These startings are like those observable in the advanced condition of synovitis, when the cartilages are ulcerated nearly through, and the bone cancelli immediately underlying the joint are injected; but they are more violent, and as the bone is in these cases primarily affected, such spasms commence earlier in regard to the rest of the joint-disease. Such violence and early occurrence of these pains are almost enough to mark the malady as an inflammation of the epiphysal end of the bone; and they show, as stated in the first division of this chapter, that the osseous structure just beneath the articular lamella is injected, and, when very violent, that it is probably suppurating. But the surgeon must be careful in assuring himself that he has really to do with this symptom, for when the disease occurs in young children he may often be misled. The ordinary heavy pain of a commencing osteitis increases, as we know, at night when the patient gets warm in bed, and the generally garbled and exaggerated report of the nurse will lead the surgeon to suppose the child's crying more violent than that dull pain usually produces. If he once stand for a few minutes by the bedside of a patient at night when the *startings* come on, he will not readily forget the sort of movements and restlessness they produce. The patient will probably be found lying in the position which the splint enforces, breathing quietly but rather quickly: suddenly he starts, perhaps half round, perhaps into a sitting posture, with a very sharp peculiar cry of pain, but almost before he can be asked a question he lies down and goes to sleep again. Dr. Bauer says, that if the patient be awakened he hardly remembers the attack of pain at all;[1] but this is doubtful, when we know that he remembers it in the morning; and I have found that on waking a child with this disease he always cried very much and was frightened, and could only with difficulty be got to sleep again. One could not plainly make out whether he knew of the pain, or whether it merely made part of a frightful dream of which our waking him was the dreadful climax. Older people from seven upwards, have a very clear idea of the pain; but on watching a boy, aged ten, thus suffering, I found that he did not wake sufficiently to be conscious of external objects, and went to sleep again directly; but on questioning him next day he described exactly the sort of rapid shock of pain, which the exprèssion of face and gesture indicated. We shall have occasion to recur to this symptom, as it is most important in its effects as well as in its semeiology.

Such is, in brief, the history of a strumous inflammation of the joint-end of a long bone ending in *caries.* All osseous disease is slow of character; but this form is of all perhaps the slowest, whose steps are least marked and definite, and whose commencement is so gradual that the moment of beginning can be hardly fixed. There is another form of strumous disease which also may be situated in the epiphysal ends of bones, rather more rapid in its course, whose inflammatory action terminates in a necrosis instead of in a caries. Such cases occur as a rule to persons of riper years: the first symptoms, brought on by accident or exposure to cold, are sufficiently sharp to be remarked, and are sometimes very severe; perhaps there will be a shivering fit, followed by considerable fever, and very acute pain in the bone. Gradually the feverish symptoms diminish, and even the pain will be less severe; but it recurs with considerable violence at night, and the affected head of the bone swells to a marked extent. The tumefaction is hard, inelastic, bony—is, in fact, bone rapidly formed beneath the periosteum—the swelling is not covered by thickened soft parts; on the contrary, these latter become thinner, and are tightly stretched. The disease (necrosis) is more common in the shafts than in the joint-ends of bone; but occurring in this latter, it is almost confined to the head of the tibia, olecranon process of the ulna, condyles of the femur and humerus, and being thus situated in parts very superficial, the form, shape, and consistence of the swelling are plainly made out; the soft parts are, as said above, stretched tightly over it, being more adherent than usual to the subjacent hard tissue. The pain, viz., severe aching, with which the disease began, soon considerably diminishes, and generally starting pains will come on; but these are mild and do not form a subject of dread to the patient, or of special complaint, nor do muscular contractions form a part of the disease; nor does the general health suffer to any great extent. After a time the pains of a necrosis will recur with greater violence and undergo some change in character; but these are due to the second, the ulcerative stage, by which the dead portion is separated, and in which, therefore, we should expect to find the symptoms approach more nearly those of caries. Now, the sequestrum may lie in the middle of the spongy mass, or it may be chiefly situated on some external part; or, again, it may lie close to or include some portion of the articular lamella. All these different conditions make a good deal of difference in the prospects and termination of the case, hence it is extremely important to be able to distinguish a necrosis from a caries of a joint-end, even before an external opening shall have been formed. The points of differential diagnoses may be thus given.

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[1] Baner on Hip Disease, p. 8.

DIAGNOSIS BETWEEN NECROSIS AND CARIES IN THE JOINT-END OF A LONG BONE DURING THE EARLIER STAGES.

Symptoms of Necrosis.	*Symptoms of Caries.*
Disease begins with a smart attack of pain and fever after an accident or exposure.	Disease so insidious in its attack that its actual commencement is difficult to fix.
Swelling equably hard, inelastic, bony; an exaggeration of natural form lies close to integuments, which are adherent and seem thinned.	Swelling less hard and not equably so; fluctuates obscurely in places; the parts between bone and skin puffy, thickened.
The pain with which disease began sharp and severe, but soon diminishes very much: then returns with other character—disease continuing all the time.	The pain begins less severely, but as long as disease lasts goes on increasing.

If starting pains come on they will not be very severe, and do not form a great subject of complaint.	**The starting pains very severe, and engross the patient's attention from other pains of disease.**
Permanent contractions are unusual as accompaniment.	**Permanent contractions constantly accompany caries of a joint end.**
The general health does not suffer much.	**General health very much injured by disease, sleepless nights, &c.**

It is not a necessary sequence of necrosis, situated in a joint-end, that inflammation of the articulation should follow, because the dead bone may be situated so favorably, that its separation can be secured without interfering with the joint; but it sometimes happens that a necrosis will include the articular lamella, or that pus produced in the process of separation, will find its way into the joint. In either case it too frequently sets up an acute suppuration in the cavity, which, as the irritative action still continues, is not to be combated by any of the general or local means within our reach. In such cases the symptoms of the joint malady are very urgent, and, usually beginning with inflammatory violence and great fever, end with a typhoid condition; thus, when such bony swelling with the symptoms as already described have lasted some time, there will suddenly come on violent and frequent rigors, followed by excessive pain in the joint; the pulse becomes quick and hard, skin hot, face flushed—in fact all the symptoms of considerable inflammatory fever. The joint swells, becomes hot, fluctuates, and cramps frequently arise in the neighboring muscles. However the pain rapidly becomes more severe, the power of the symptomatic fever in a very short time gives way; occasionally, it is so ephemeral as not to come under our notice, and it yields place to symptoms of a low typhoid character. The pulse becomes very quick and small, the face anxious, the tongue brown, the thirst extreme, the skin burning. At last the swelling is no longer confined to the joint, but spreads over the whole extremity, which becomes red, and perhaps œdematous. If the joint or soft parts around be cut into, still more if they be left to break, the pus which escapes is of a dark color and putrid. The patient may die, from the mere oppression of the disease, in delirium and pain. Even when it is attempted to save life by amputation, it too frequently happens, as in such a state of constitutional disturbance we must expect, that purulent infection nevertheless puts an end to atrocious tortures.

Fortunately such cases are of rare occurrence, and it is a still more rare circumstance that the pus and débris of necrosis should find their way into a joint before having produced an opening through the skin, whereby a probe may be introduced, and the extent and direction of the sequestrum sufficiently ascertained, either to allow us to prevent such a breach into the joint, or at least to make us prepared to combat its effects.

Caries, however, which is the more common disease of the end of a bone, does not set up violent joint-inflammation, but rather a slow chronic attack, as above described (p. 243), causing thickening and granulation of the synovial membrane and enlargement of the whole articulation, whereby, however, the part primarily affected retains the largest share of the symptoms, and the bone becomes very sensitive to pressure. The skin over the swollen joint, and more particularly over the diseased bone, becomes white and smooth, giving to this complaint, among many others, the name of white swelling. After a time, the third stage of the caries commences by the formation of one or two soft fluctuating spots, which at last redden, point and burst, giving exit to some amount of pus. The formation of matter among the soft parts is always accompanied by increase of pain and aggravation of the general symptoms. These are not relieved by opening the abscess; on the contrary, they are rather increased. From the wound produced by the bursting of the abscess crop forth florid granulations, the discharge becomes thin and excoriating, and it discolors silver. In a little time the cavity of the abscess contracts, but only partially, leaving a passage or sinus, which leads with many turns and windings to the diseased bone. The granulations which crown these sinuses are deep red (crimson), and bleed very easily; round the opening for some distance the skin is thin, contracted, and has a peculiar blue look. The surgeon will naturally pass a probe into the sinus, and endeavor to feel therewith the rough surface of diseased bone, but it is very likely that he will not come at once upon such surface, for the turns and windings of the sinus, sometimes along a piece of fascia, sometimes round a tendinous sheath, may easily check the passage of a probe; the blue circumference to a sinus filled with bright florid granulations is a sign so positive, that the mere fact of not being able at once to reach diseased bone should not be allowed to negative its inference. A little patience and some ingenuity will, on a subsequent visit, find the proper channel; but never for the mere sake of feeling the diseased bone should the probe be thrust violently through opposing structures. The bone is found rough, but generally soft, and the rotten cancelli yield a little to gentle pressure with the probe, the superficial portions breaking away. This is very different to the sensation of a necrosis, and it is important that the two should be distinguished; hence we will again contrast their appearance.

DIAGNOSIS BETWEEN NECROSIS AND CARIES IN THE JOINT-END OF A LONG BONE DURING THE LATER STAGES.

Symptoms of Necrosis.	*Symptoms of Caries.*
When pus forms in the soft parts, and more particularly when it has been let out, the symptoms diminish.	During formation of pus the general and local symptoms increase in intensity, and continue to increase even after an external opening has been made.
The sinuses are crowned by florid, but not brilliant, granulations, which do not bleed with extreme ease. They are surrounded by normal or slightly altered skin.[1]	The sinuses are crowned by florid brilliant crimson granulations, which bleed extremely easily. They are surrounded by thin blue contracted skin.[1]
The pus is not large in quantity, and is in general nearly laudable.	The pus is plentiful, thin, and irritating.
A probe passed along a sinus to necrotic bone finds the passage tolerably straight and simple. The bone is hard, brittle, sometimes movable. Often one may feel the probe pass through a sinuous opening (cloaca) in bone before it comes to the dead portion.	A probe finds the diseased bone surface with difficulty on account of the windings of the sinus. The surface is rough, slightly yielding, not brittle, though parts give way—it gives an idea of softness.

Such are the distinguishing marks as far merely as the symptoms relating to the bone disease are concerned. The actions induced in the joint are also very different.

Necrosis sufficiently near to implicate the joint, produces, when inflammation is set up, a more rapid action, with fluid effusion into the cavity; the osseous swelling reaches, however, a higher point before such action commences. The articulation is movable without pain, the muscular spasms form a hardly prominent part of the disease, and permanent contraction of the flexors rarely takes place to any marked degree, until the synovial membrane has actually become affected.

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[1] The mouth of a sinus leading to a necrotic bone puts on a far worse appearance when the sequestrum, having become loose, begins to press for exit against the soft parts, the granulations then become crimson, and the discharge thin. Even a dressing which confines the matter, or a passing ill state of health, will cause the granulations to put on a worse appearance for a time. The bad appearance of the sinuses leading to *caries* never changes till the disease begins to get well. Stromeyer (Handbuch der Chirurgie) makes a similar observation.

The carious disease has on the contrary brought the joint into the following condition. The swelling is due to two causes, thickening of the subsynovial tissues, and of the deep fibrous textures around the bone; it is hardly at all due to effusion into the joint cavity. It is soft, and more or less pulpy throughout, but it has a foundation of very considerable hardness over the diseased bone, where the tumefaction is most marked. The anatomical osseous points project abnormally, and the bone is tender on pressure. The swelling is white, the skin looking sodden and unwholesome, and it is marked by the mouths of sinuses, whence pout florid, crimson granulations, bleeding with the least touch, and secreting thin acrid pus; the limb is firmly contracted, the joint more completely and rigidly flexed, than in any other disease. The patient is pale, worn, anxious, and any attempt at movement is dreaded in an extreme degree. Some of the symptoms, as those having reference to the shape of the swelling, are modified by the sort of joint bones in which the disease occurs; thus in the carpus and tarsus no such strong demarcation can be felt, the tumefaction is more general, and much effusion into, and thickening of, the tendinous sheaths occur. Again, at the tarsus, if the lower and anterior part of the astragalus, or the other component bones be affected, it is not so easy clearly to define the original locality of the swelling, the whole foot becoming thick, clumsy and puffy, from great alteration of the tendinous sheaths of the other fibrous structures, so abundant in this position. When sinuses have formed, their position, and the direction in which a probe strikes on diseased bone, must guide the surgeon in forming an opinion as to the locality of the disease. Even in this stage accurate diagnosis is not always easy, and it must be remembered that, both at the wrist and instep, one of the small bones will not long continue ulcerating without involving others.

The muscular spasm which plays so important a part in this disease, sometimes produces dislocation, as has been already pointed out. (See p. 246.) It is unnecessary to enter into the symptoms of spontaneous luxation; every surgeon will recognize such as soon as he sees it.

Dislocation, however, although an occasional accompaniment of the disease, is neither a constant nor necessary result of articular caries; when it does occur, the symptoms very much abate, and the patient recovers (if recovery it may be called) with a distorted and probably a useless limb. If the disease continue to get worse, whether dislocation have or have not occurred, the pain and sleeplessness increase, hectic is set up, and the body becomes frightfully thin. Abscesses form one after another, at first in the neighborhood of, afterwards further and further away from the joint, and among the deep muscles; the periosteum of the shaft itself becomes swollen and may be felt through the muscles in that condition. At last, exhausted by discharge, pain, &c., the patient sinks and dies, unless the disease be removed by the knife.

Sometimes, though rarely, the malady becomes checked rather suddenly. When the symptoms appear all tending to the worst termination, some increase of constitutional vigor may give hopes, which a subsequent visit may increase until the surgeon becomes justified in forming a more favorable prognosis than he could have done shortly before. The first sign of this improvement is amelioration in the general health, diminution of the painful starting of the limb, better sleep at night, and return of appetite. The local signs are, gradual decrease in the swelling in the limb and of tenderness over the bone, decrease of discharge and improvement in its quality, gradual diminution of the abscesses among the muscles and closure of the sinuses without opening of any others, accompanied by return of the tissues to their firmness and normal resiliency. It is sometimes curious to observe how the mouths of the sinuses close in regular order, beginning at the one farthest from, and gradually approaching nearer and nearer to the disease.

TREATMENT.

First Stage.—In no malady is the command *veniente succurite morbo* more advantageously obeyed than in this. If the patient come under judicious treatment in the earlier stage of the disease, while yet the symptoms are those described in the beginning of the second division of this chapter, he should have a very fair chance indeed of being cured. If he have been neglected, and only have recourse to treatment when the second stage has commenced, he will certainly have to undergo a very long and painful illness, and will be likely to recover with a permanently injured joint, or be obliged to undergo a surgical operation, or perhaps he may never get well at all.

Sir B. Brodie, from whom no writer of the present day would willingly differ on the subject of joint disease, has discussed the subject of treatment too generally, and his remarks refer, I believe, to a further advanced period than the early one, now under our consideration. The earliest condition (marked by mere pain, reluctance or inability to move the joint, and some not easily perceptible swelling, while yet there is no muscular spasm or starting pains at night) should, in all but the most feeble constitutions, be treated, I am quite sure, more actively than he has advised. Two classes of cases come under our notice—the one very chronic, the other less so; either may occur in delicate, and pale, or in fat and florid, children. Such circumstances make a difference in the kind, but scarcely in the vigor of the treatment to be adopted. At p. 129, two forms of struma were described; at p. 147, the treatment best adapted to each. Now, although either strumous state may light up an inflammation in any tissue of the body, the slow, long-pending osteitis belongs especially to the coarse clumsy condition of struma, as a deep sluggish ulceration of the cornea, with congestion of neighboring parts, is an accompaniment of that form of the disease. But inflammation of an epiphysis may also be developed by the struma with fine connective tissues, yet such disease is more rare, more active, getting either well or worse more quickly. It is comparable to the superficial, rather ephemeral and non-congestive inflammation of the cornea, which leaves a thin but expanded nebula on the surface. Let us take our example of treatment from what we see of its effects on the eyes. The patient comes with the eyes watering and discharging a thick Meibomian secretion, holding down his head, and dreading light beyond everything. A brisk but not drastic purge with mercury is administered, and when it has acted and brought away the thick mucus that hangs about the lining of the intestine, he is able to look at the light without much difficulty, and the brunt of the disease is passed. It has been my fate to see cases, that had hung about for weeks, and whose treatment had been judicious, except that from want of a clear intestinal surface medicines could not be absorbed. Such a purge has been always productive of benefit, and allowed the medicines, perhaps the same as were previously useless, to have their proper effect. If, then, a child be brought to the surgeon with the early symptoms of articular osteitis, if he be gross, somewhat coarsely moulded, and have the discolorations of skin described at p. 130, he should be treated by an immediate purge containing mercury, which is to be repeated if necessary.

This simple means, though strongly insisted upon, is not intended to be held up as a cure of early osteitis; it is the mere initiative. Much has been said against the administration of mercury in strumous disease: probably the wholesale condemnation of the medicine is intended only to apply to its use when pushed far enough to touch the gums. Let me again illustrate the applicability of the remedy by referring to strumous ophthalmia in a later stage than when it was before used as an example—when the cornea has begun to be dull in one or more spots; beginning in fact to ulcerate. I have seen treated, and formerly have myself treated such cases, with iodide of potass, cod-liver oil, iron, quinine, and other tonic and antistrumous remedies without avail; then, by the administration of a few very mild mercurials, have stopped the tendency to ulceration, or have healed ulcers already produced. In the same way as before we may apply the remedy found useful for scrofulous inflammation in one place to the same disease in another. The prescription which I generally use in this form of epiphysal inflammation is one grain, or, for strong children, two grains of gray powder, with one grain of quinine, night and morning: such a dose I continue during two, three, or even four days, then give the quinine alone at the same intervals. The mercury should never be pushed beyond a slight alterative effect, and is not to be repeated unless the skin and eyes again become muddy and thick in hue. Very many early inflammations of a joint-end in this particular constitution come under my care in the course of the year, and I have no hesitation in recommending the above mode of treatment as capable (combined of course with suitable local means) of checking the diseased action in a large number of instances.

Strumous persons, with thin skin, clear bright complexion, and finely-cut features, are not benefited by mercury, even in slight alterative doses; neither is a purge, as above described, required so constantly, as in the coarse-conditioned struma, and such remedy must be of a non-irritating description. Cases in which a bone inflammation is developed in the delicate-formed struma are marked by a higher degree of pallor and debility than is present in any other form of commencing scrofulous disease—except, perhaps, in a rapid species of phthisis. The inflammation itself is less chronic in quality, and tends to pass more quickly into suppuration than the sluggish inflammation of the other form of strumous disease. The local treatment should be more decidedly and actively counter-irritant, but as little debilitating as possible; e. g., blisters allowed to heal at once, and repeated on various parts in the neighborhood of the disease, or the actual cautery; while all such remedies as issues or setons, that keep up a continuous and debilitating discharge, are inadmissible. Of cod-liver oil, quinine, and steel we need not speak more especially here. Their great value in this form of strumous disease was pointed out at p. 143.

Iodine simple, or combined with potassium, and its action on struma, were discussed in the latter part of Chapter V.: we need only observe on the present occasion, that it is reputed to have a powerful effect on osteal inflammations; but my observation leads me to conclude that its action is more beneficial in those forms that lead to the production of new bone, than in those which tend to necrosis or rapid caries; and the results of some cases that have come under my notice seem to show that its administration has increased the tendency to suppuration; at all events it is not adapted to cases of this latter kind of strumous disease. Many persons have, on theoretical chemical grounds, been tempted to recommend the administration of some remedy containing an osseous constituent, or constituents. Phosphoric acid, lime-water, hypophosphite of lime, have been thus advised. My experience of the first is, that it acts like any mild mineral acid; of the second, that it disorders the stomach without producing any effect on the bones; and of the last, that it has no influence on the system or malady whatever.

Locally, the first and most important indication is the maintenance of entire rest. Beyond this Brodie condemns all local treatment as positively injurious, and more especially the repeated application of leeches; while Stromeyer[1] says, that in all but leucophlegmatic, nearly chlorotic children, their use, if frequently repeated, is very great; and he adds—"Until I became a hospital surgeon, I myself had but a small opinion of their value in scrofulous joint-disease; but afterwards I became persuaded of their use." In my experience only one case has occurred in which I deemed it advisable to apply leeches. On that occasion I ordered three, and the effects were beneficial. The inflammation followed a fall, and was rather more acute than in the generality of cases. But the truth is, that Brodie and Stromeyer differ because they do not sufficiently define the particular cases of which they speak. In the very chronic malady, when the joint-end is not tender nor hot, in fact only suffers those symptoms which indicate congestion, all local treatment beyond rest is injurious. Such cases depend on constitutional causes: in all probability every one of the joint-ends will be large, and the one which appears painful is only a little differently circumstanced to the others. Fresh air, sea bathing if possible, good food—in fact, the best hygienic treatment and tonic regimen, afford the greatest probability of cure. Any irritation to a part thus circumstanced could only tend to change the congestion into an inflammation. The limb must be kept at rest, and this in a manner, if the nature of the joint allow, that does not altogether preclude exercise—and certainly not fresh air. If any local treatment at all beyond this be used, it should be soothing and tonic. I have seen benefit from a cold douche after the ordinary ablutions of childhood had been finished; but to debilitate by the abstraction of blood, to irritate the part, not as yet inflamed, by blisters, &c., is decidedly injurious.

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[1] "Handbuch der Chirurgie," p. 490.

But on the other hand, there are not a few cases in which a quickly growing child acquires from some accident or undiscovered cause, inflammation of an epiphysis, which is much more decided and rapid. In such cases, the part, if superficial, will be tender and hot, the symptoms in fact mark an active state, and require a more decided plan of treatment than the above; perfect rest by means of a splint must be secured, and counter-irritation at some distance from the inflamed part be used. The form of counter-irritant must depend on the patient's age, strength, and irritability; a blister, the liquor vesicatorius, or other preparations of the Spanish fly, occasionally produce unpleasant effects in very young children; a repetition of rapid sinapisms is, in such instances, preferable; sufficient distance from the inflamed spot is already procured by nature, when the joint lies deep, as the hip or the shoulder; but if the attack be at the condyles of the femur, the counter-irritant should be applied above the inner condyle, which is the part most frequently inflamed; when the skin has been acted upon by whatever irritant the surgeon has employed, it is judicious to keep up the action for some time, by means of a stimulating liniment or otherwise. It is unnecessary to mention any particular means of inflaming the skin; every surgeon who is alive to the resources of his art has a dozen such at his fingers' ends, and will take care to adapt the power of his remedy to the violence of each case. It is always to be borne strongly in mind, that during the stage of congestion, or early inflammation, it is very generally possible to procure resolution without further mischief, but that when once suppuration has begun, it is barely possible to prevent caries, and more or less injury to the joint.

It is at this time that the diagnosis between caries, necrosis, and central abscess in the bone, becomes so important; for if the surgeon can decide from the sort of pain, the quality of the swelling, and the condition of skin over it, that he has to do with the two last, and not the first, he may, by prompt interference, save not merely a great deal of pain, but perhaps the joint. It is useless to interfere before the necrosis have formed and separated, for even were a good deal of inflamed bone to be cut away the action would not thereby be limited; but as soon as the appearance of surface leads us to conclude the bone loose, or as soon as an external opening has formed, it is well, be the object to find an abscess or dead bone, to trephine, and to search for what has been expected. If the necrosis include some of the joint surface, a very rare circumstance, the treatment would no doubt hasten on a suppurative synovitis; but in a large majority of instances, the disease only skirts this locality, which would, however, become involved in the future ulceration and suppuration around the sequestrum. The surgeon, before forcibly tearing away the necrotic portion, will carefully examine the extent of that part, which runs towards the joint, and adapt his procedure to the circumstances of the case. When the disease is an abscess in the head of a bone, no hesitation should cause delay; as soon as the osteal and periosteal thickening, and the peculiar pains which accompany that malady appear, the trephine should be applied, and the nearer the disease be to a joint, the more rapidly and decidedly should we act.

When those peculiar starting pains come on, which mark the commencement of the second stage, the surgeon knows that his struggle with the disease becomes more serious,[1] and that his utmost skill will be needed to save the joint. These pains, which, as already stated, I believe to supervene when the inflammation attacks the bone immediately beneath the articular lamella, begin by degrees; in the first week or two of their appearance, they may not form a subject of special complaint, and they may not be present every night, but only occasionally; they gradually, however, become more severe and constant, until they are, *par excellence*, the great horror of the disease. As these pains increase in severity, so does the tonic contraction of the muscles (chiefly flexors) increase in power, and the malposition of the joint become more decided and fixed. Under these circumstances, the proper plan of treatment is to fight against the irritation, and to counteract the muscular contraction.

Medicinal Sedatives are all but useless. I have given opium in a sufficient dose, and have heard the next day, that the patient slept no better, and was not freer from the dreaded starting. I have then given a larger dose, and taken the opportunity of seeing the patient at night. It was not possible to judge of the depth of the sleep during the quiet intervals, but the startings were of the same sort as already described (p. 136). I place great reliance upon opium in many forms of painful disease; some surgeons have confidence in its action upon the pain now under consideration, but among the multitude of cases in which I have used it and seen it used, not one has given me any belief in its efficacy. Indeed, were it here affirmed that the drug increased spasmodic startings, the statement would have great support from analogy, and such an idea has certainly not been contradicted by the action of such remedy in any one case that has come under my notice. Hyoscyamus is far too feeble to act against so violent a symptom; the same may be said of conium. The tincture of sumbul, as prepared by Messrs. Savory and Moore, seems to me more efficacious, but the whole class of remedies is not to be relied on for this particular object. Much more faith may be placed in a diffusible stimulant given at night. Sulphuric ether, compound spirits of sulphuric ether, chloroform dissolved in alcohol, are all valuable; a pleasanter and perhaps quite as efficacious a means, is a little scalded port or sherry, and these in my experience have done more good than sedatives; but if the latter medicines are to be administered, they should be combined with the stimulant. During this period of the disease, tonics should be of the hæmatic character, such as quinine, iron mineral, acids, bitters, rather than of the nutritive form as cod-liver oil, sarsaparilla, &c.; but if the patient be losing flesh rather rapidly, then the oil may be advantageously combined with them.

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[1] Let me again warn the attendant against placing confidence in a nurse's report, without subjecting her to strict cross-examination. I have excluded from my descriptions all that has particular reference to the hip, to whose diseases a special chapter is devoted.

The Local Means of subduing the spasmodic startings are several. When these pains set in, the patient is usually treated with some more powerful counter-irritant than those which have been at present advised, namely by caustic, or perhaps by the actual cautery, and nearly always with the effect of subduing the pain. It does not apparently matter what caustic be used to destroy the skin, as far as this one effect is concerned; but the hot iron acts most decidedly. After any application which causes destruction of the skin to the size of a fourpenny-piece or upwards, the starting pains, and the vague but distressing sensations along the shaft of the bone, will very much diminish or cease altogether. But let us not be blinded by this apparently great step; before the sore thus made can be healed, the pain will return, sometimes with less violence than before, sometimes with even greater. Unfortunately we have no power of looking into the joint, and finding out whether the disease stood still during the absence of pain; but we see cases run their course from end to end under the constant application of issues, and the occasional use of setons, so that the skin action and the bone action are not incompatible. Whether or not any treatment has the power of checking so slow an action as caries is a point so difficult of proof, that one ought to be very circumspect in refusing all credit to a remedy which has been trusted in by some of our best surgeons. Still I must confess great scepticism in the value of such means in this disease. When the starting pains first commence, that is, according to our belief, when the bone cancelli underlying the joint surface first become inflamed, such application may be of avail: a case was thus treated by myself, which would apparently have gone on to caries, had not the cautery been used. On the other hand, there are a great many cases which have been thus treated even very early, and yet have run on to ulceration, &c. It is, therefore, very doubtful whether such treatment does any good even in the *earliest* part of the second stage; and under such circumstances, if the patient be in pretty good health, I would give him the benefit of the doubt; but issues should never exclude other treatment, nor should so blind a reliance be placed on their value that one after another be opened, while the patient loses strength, appetite, and sleep.

There is no doubt, however, about this remedy later on, in the second or in the third stage. When the starting pains have lasted some time, when the patient is worn, and shows marks of debility, when the face becomes expressive of suffering, the use of caustic, even of the far more painless cautery iron, is not advisable. Such applications are made, we know, very frequently, and will always be tempting, because their first effect is to quell the starting pains; but they return at this time much more quickly than at the first part of this stage. If, in the beginning, we could subdue the spasms by these means for a week or a fortnight, we can at the latter end hardly stave them off over two or three nights; they will, in fact, begin to return before the slough has separated, and then the treatment will have added an open sore to the other causes of debility and irritation.[1] The application, when pus is formed in the soft parts, is to be still further deprecated. Our patient is by that time in a sufficiently weak and irritable condition to render such means worse than useless.

By denying all but a small value to exutories, and allowing that value only in the earlier stages, we do not affirm that there is absolutely nothing to be done in these cases. The truth is, that it is doubtful whether, except in very few instances, we ever can *cure* a chronic disease: all that we can do is to put the patient in the best possible position for getting well; or, in other words, remove as much as possible the *morbi causa.* We cannot, in the present instance, rapidly remove the cause of the disease—it lies deep rooted in the original constitution; but we may remove the condition which keeps up and aggravates the morbid irritation, and which, while continuing, prevents any real improvement. These conditions are, as we have seen, the continuous pressure which the muscular tension causes one bone to exert on the other, the deformity and forced position thereby produced, and the short sudden spasms, which seem also to originate in that pressure.

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[1] The whole of these remarks are strictly limited to caries as a primary disease of a joint bone.

The first treatment necessary for this condition is to place and keep the limb in a proper position (the proper posture for each joint has already been discussed, p. 151), and if the case have come under skilled treatment so late that a false posture have already been assumed and maintained, it will be necessary to change it for the true one. This may be done suddenly, and by force, while the patient is under chloroform—the contractions being stretched, and giving way; or it may be effected, also under chloroform, with subcutaneous section of all those tendons which oppose the change of posture. Again, the stretching may be brought about by degrees, either with or without section of the muscles. It is often astonishing to find how much this mere change alleviates pain, if the right means have been used; but if the wrong ones have been practised, the stretching of the muscles and fibrous structures produces violent spasm and contraction, to which the splint prevents the limb yielding, and which produces intolerable pain. In such cases there is no doubt but that the tendons ought to have been divided; and even after the limb have been straightened, division of all the flexors (sometimes of one or more other muscles) subdues at once the consequent pain. Nevertheless, there is no doubt that we ought to choose our cases for either measure so fairly, that we neither use mere force, and be subsequently obliged by the patient's sufferings to divide the tendons, nor, on the other hand, ought we to cut unnecessarily a single muscle. The success, then, in our choice of means will depend on careful judgment of the condition of the parts. If the contraction of the muscles have ceased to be active, but have become passive contracture, not sufficient to cause much deformity by flexion, we need not divide the tendons.[1] When the contraction is active, the muscles will only bear very slight stretching without producing great pain, and this condition must be judged by the sensation which the flexor side of the limb offers to the touch. Very little practice will enable the hand to distinguish pretty accurately between the *corky* sensation of a contracted and the *cordy* one of a contractured muscle. However, more weight may be laid upon the amount of the clonic spasms:

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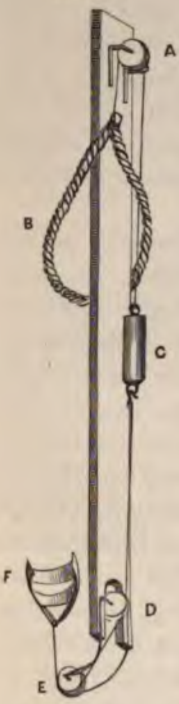
[1] The term "much deformity" in the text is relative—its value consists in the size of the angle through which we must draw the limb in order to get it into the desired position. In most instances, when this is about, or less than, half a right angle, or 23°, we would say the deformity is not great; but it must be remembered that the longer the muscle the greater distance may we stretch it with impunity.

when these are present to a distressing extent, it is unwise suddenly to alter the position of the limb, save to a very small extent, without dividing the opposing tendon or tendons. I have seen this done, and formerly have, on one or two occasions, done it myself; but will not again, unless under very peculiar and exceptional circumstances, quickly straighten a joint without tenotomy while active spasm continues. When the limb has been placed in a proper position, and opposing tendons divided, the sharp starting pains cease nearly or altogether, and no local treatment beyond a well-adapted splint is necessary.

Many cases come under notice in a condition when it is not advisable to have recourse to sudden alteration of position. Such are the earlier stages, while yet the deformity of limb and rigidity of muscle are small; or later stages, in which, owing to treatment, the deformity may be slight, but the muscle is passively contractured, and starting pains form no very prominent symptom. In such cases a splint, adapted with a screw, or other means of tension may be applied, and a gradual system of straightening may be adopted. This may fail, however, in certain instances, by lighting up a return of clonic spasm, or producing great pain, even some inflammation of the joint; it is then advisable to leave off the splint, and to have recourse to the more rapid means of overcoming malposition. Another splint, presently to be described, wherein India-rubber springs form the active extending force, may, in such cases, be used with advantage. It is better than the screw splints, because the power is a constant and equable quantity, while that of the screw is a quantity which increases by sudden and unequal increments.

If the joint have been straightened with the help of tenotomy, little more, as already has been said, is necessary to subdue these pains; but if it have been thought advisable not to divide any tendons, or if the case have been seen before any deformity has come on, other means may be adopted to overcome the sharp starting pains, and with them that action, whereby they are accompanied, rapid ulceration of bone. It has been said that these are greatly aggravated by, and at last probably altogether dependent upon, the pressure of one bone on another, increased by the muscular contraction. To counteract such force I have invented a form of splint, and find much advantage in its use. The principle of its construction is to make a strong India-rubber spring, or accumulator, act as both extending and counter-extending force. For this purpose it is fastened by each end to a piece of catgut that plays round pulleys, attached to either end of the splint. I will describe particularly the arrangement for the knee. A long Desault's splint is furnished at its upper part with a loop of strong wire, or of steel (A), which carries a small pulley, and which projects outwards about an inch and a half. The lower part is provided with a bar running across the space of the notch, and also carrying a pulley (D). From the lower end of the splint, projecting inwards an inch or an inch and a half, is another loop, carrying a third pulley (E). A perineal band (B), passing round the upper part of the limb and splint, has a piece of rather thin catgut (violin string *A* or *D*) attached to it, which going through the upper loop of wire runs round the pulley (A), is brought down on the outside of the splint, and is attached to one end of the India-rubber accumulator (C). Round the foot and ankle are fastened two pieces of webbing (F), which lace over the instep, and to both sides of which is sewn tape, forming a loop below the sole of the foot.[1] This tape affords attachment to another piece of catgut, which plays over the pulleys, in the lower part of the splint (E and D), and is tied to the other end of the accumulator (C), with the fitting amount of tension.

Fig. 16.



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[1] A broad well-padded leather strap going round the ankle is as good, and strapping plaster, as described in Chapter XIV., is better than either. A few little contrivances will be found to aid in the ease with which the apparatus may be adapted. For instance, extension need not be made on the perineal strap when the splint is bandaged on the limb; but the accumulator may be fixed to the upper part of the wooden splint. There will be some tendency to ride upward, owing to the mode in which the catgut passes round the lower pulley; hence the perineal band should be fastened to the splint, and the tension on it will be very slight. (See Chapter XIV.) It will be found convenient to have the accumulator near the upper part of the splint, and to fasten to the lower catgut a piece of tape which can be readily tied and untied from the ring in the India-rubber. This being a treatise upon a special subject, the author has no right to turn to another, but he must point out the value of this extending force in fractures at the upper part of the thigh. In caries of the vertebra some modification of it may be found useful.

This splint may, by fitting modifications very easily applied, be adapted to any joint.[1] It is very useful when it is desired to produce gradual extension of a joint, as of the knee; or, when properly adapted, of any other articulation. The ordinary plan of attaching a weight to the end of the foot, for extension, and fastening the patient by cords to the upper part of the bed for counter-extension, does not answer, as it produces such weariness, that no person can bear the constraint long enough to allow of much benefit. This mode of getting extension and counter-extension on the splint itself, confines nothing but the joint, and even that to as slight a degree as may be desirable; for instance, in the case of a slightly bent knee, it is not absolutely necessary to bandage the apparatus to the limb; the force of the spring keeps it sufficiently in place. It is important only that the anklet and perineal band should be duly padded and kept clean.

Besides the mere power of straightening a bent joint (only a secondary use of the splint, and not that for which it was invented), the India-rubber spring counteracts that force, which presses the bones too violently together, thereby producing the spasm, keeping up the irritation and the caries. I have seen the most violent pains yield gradually to this contractile force: it appears, by its unvarying, constant, and yet not unyielding power, to tire out the muscles, to overcome their spasm, and to keep the joint surfaces, if not asunder, still not pressing together. It is, however, necessary that all the straps and bands be padded, and fitted with the nicest care.

These means, as far as my experience of them reaches, do not fail in subduing to a great extent, or altogether, the distressing starting pains, which so wear the patient with anxiety and sleeplessness; but there is another more powerful and more heroic method, namely, to cut through the tendons of the contracting muscles. This plan is adopted by Dr. Bauer, of Brooklyn, New York, for cases of hip-joint disease, and he gives the most favorable report of its efficacy. It has been objected to such treatment, that when the tendons reunite, the same set of symptoms must recur; but it should be recollected that the muscles are lengthened by this means, and would not therefore act with such power, and that any extending force can be used with the greater efficacy.[1] I have never performed tenotomy for the purpose of preventing the starting pains, when the limb has been quite straight, but have done so to relieve them, when produced by forcible extension, with the greatest advantage. There does not exist any valid objection to the operation, and if the mere application of an extending force does not produce the desired result, I, having seen tenotomy relieve starting pains, should not hesitate to use such means, since no discoverable evil follows the operation.

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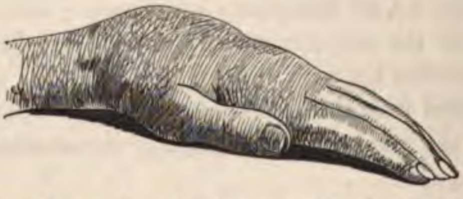
[1] A special description of its form, as applicable to hip-joint disease, is given in the chapter devoted to that subject.

These remedies and appliances are applicable to the second and third stage of the disease, but in this latter, there comes on another symptom which indeed marks its destructive course; namely, formation and burrowing of abscess in the periarticular tissues, and among the muscles of the limb. No treatment whatever is the best treatment of these abscesses; to open them is a very great error; such interference always produces aggravation of all the symptoms: this result, indeed, follows their bursting, hence every treatment that might hasten such event is to be avoided; neither poultices, pressure, iodine, nor other application is useful, but rather the reverse. All that art can do to effect a cure is, as before said, to place the limb in the best possible position for getting well; to counteract, by one or more of the methods laid down, the morbid muscular contractions; and to support by all means in our power the general health of the patient. All the best applications of the highest art will sometimes, however, fail, and if the surgeon's efforts be unable to cure the joint, they must be ultimately directed to save life, and some operation for the removal of the disease must be resorted to. These form the subject of a special chapter, and the reasons weighing for and against each are fully given.

Cases of this Disease.

Case L.—William Butcher, aged 28, from Alford, near Guildford, came into the Charing-Cross Hospital, 13th March, 1860, with disease of the right wrist. Mr. Hancock, under whose care the man came, kindly made the patient over to me.

Fig. 17.



About ten months ago the wrist became painful; he thinks he sprained it, and tried pumping on it. At last, not being able to work, he had to go to the Union; the medical man lanced the wrist once and applied linseed poultices. Starting pains came on about a month after the beginning of the disease; the wrist is much swollen and shapeless; the tendinous sheaths, both at the back and in front, participate in the swelling; the whole is puffy and doughy, with harder and softer parts; the end of the ulna is enlarged; over the back of the metacarpal bones of the index and ring-finger behind, there is a greater tumefaction, which fluctuates; over the back of the unciform there is the mouth of a sinus, which still weeps.

It was explained to him that there was little probability of our being able to save the wrist; but before having recourse to the last resort he wished to have some means tried. It was determined to use the actual cautery, though without hope of checking the suppuration then going on in the bones. Accordingly, under chloroform, three lines were drawn with the hot iron.

16th April. The cautery lines are all healed; but, as expected, no improvement has taken place.

5th May. I amputated about an inch and a half above the wrist-joint, and afterwards examined the part.

Examination.—Tendons of extensors with their sheaths of thumb and index healthy; common extensors matted together by soft tissue and suppurating; an abscess over commencement of metacarpal bones of index and middle finger, which had not penetrated through the skin; flexor tendons also matted together and suppurating; tendons of extensor carpi ulnaris sound; periosteum over the end of the ulna much swollen and puffy; the bone itself carious all round, studded with holes and little osteophytes. All the bones of the carpus surrounded by pulpy tissue of synovial membrane; articulating surface of the radius deprived of cartilage, rough, carious, and covered with pink pulpy tissue (granulations). First row of metacarpal bones on the surface, where they articulate with the radius, carious, deprived of cartilage; on their other articulating surfaces partly deprived of cartilage and carious; in some parts the cartilage still remaining was thin and sodden, here and there detached from the bone; the semilunar and the scaphoid were quite soft, converted into a fleshy mass with thin network of bone running through it. The second row of bones were also carious, but in a less advanced condition, more of the cartilage remaining than on the first row; the cartilage throughout could be stripped off like thin tough membrane, and left beneath a pink pulpy material (granulation from the cancelli).

Microscopic.—The synovial membrane was converted into a structure consisting entirely of round nucleated cells, bare nuclei, and granules; the tissue upon the bones in the absence of cartilages, also that which was left when these were stripped away, was precisely the same. The cartilage itself, thus thinned, had, for the most part, undergone fatty degeneration; the cells were in some places full of oil-globules; in other parts, and these next the free edge, the whole corpuscle was full of oil, the cells having, apparently, deliquesced; in other parts of the section the condition was one of atrophy, the corpuscle and the cells being very small; the hyaline substance is fibrous wherever the cells are fatty.

The carious bones had their cancelli filled with pulpy granulation tissue and pus; the bony walls very plainly laminated; lacunæ enlarged, light, full of nucleated cells; canaliculi large as a rule; Canada balsam penetrated very easily.

CASE LI.—Alice Blackman, aged 6, came to me at the Charing-Cross Hospital 14th December, 1859, with pain of the right knee.

The only change in form about the joint is that the inner femoral condyle is somewhat protuberant; on examining it by touch the tissues over that part are found thickened; the child cries with pain when the joint is moved; more particularly if it be either bent or straightened beyond a certain point. Pressure upon the inner condyle appeared to produce more pain than equal force exerted on the other. The child was fat, dark, coarse-featured, with swollen lips, red edges to eyelids, and large joint-ends to the bones generally; the left knee, sound, was inclined to bow inwards. She was ordered to take a purge of calomel and jalap; to have a splint nearly straight applied to the outside of the thigh and leg; a blister above the seat of pain; to be dressed with the iodide of potass ointment.

30th. The child came back as directed on the 16th, and was ordered one grain of quinine with sulphuric acid three times a day. She has been getting better, but to-day the complexion is thick, the breathing short, and throat stuffed with mucus; there seems, also, more pain in the joint. Ordered another purge of calomel and jalap; when its action is over, to take the following, in pill, night and morning:—

℞. Hydrargyri c. cretâ gr. ij.
Quinæ disulph. gr. j.
Mist. acaciæ q. s. M.

To let the blister heal.

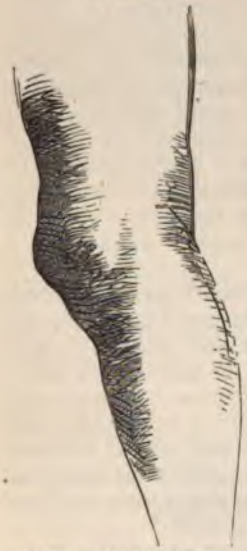
6th Jan., 1860. She took the pills for four days; is now much better, less heavy, complexion clearer. Return to the quinine and acid; to paint the inside of the joint with tincture of iodine.

Feb. 17th. The child well; the joint has not been inflamed.

June 8th. Alice Blackman fell down stairs and came back to the hospital with a cut on the forehead, the skin scraped off her nose, and other little injuries; but she at the same time hurt her knee, and the pain in it makes her cry a good deal, especially at night. The inner condyle is altered in shape, as can be detected by the sense of touch; but it is hardly more protuberant; it is tender on pressure and hot. She cries when the knee is moved more violently than before. A nearly straight pasteboard splint to the outside of the thigh and leg; a blister above the inner condyle; to be dressed with zinc ointment; iodide of potass mixture to be taken three times a day.

20th. She has had another blister over the seat of pain; there is less tenderness, but the child cries at night a good deal. It appears that she does not wake up suddenly, but has some difficulty in going to sleep: when she does wake, she does so with effort, and cries. It was evident that these were not the starting pains,

Fig. 18.



Strumous osteitis at knee.[1]

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[1] The abnormal projection of the inner condyle is somewhat increased by a serous effusion under the periosteum.

but only the dull aching of the earlier stages. Ordered to paint the joint with tra. iodinii; to continue the mixture, and to take for a week the following, in pill, night and morning:—

℞. Quinæ disulph. gr. j.
Hydrarg. c. cretâ gr. ij. M.

25th. There has appeared over the most prominent part of the inner condyle an increased tumefaction, which fluctuates; the fluid is deep. There are at present no pains which appear like starting of the limb. To take one grain of quinine, in pill, night and morning; to leave off the iodine. The joint was drawn at this time.

July 2d. The whole joint is swollen and puffy; the enlargement does not depend upon fluid effusion into the cavity, but on periarticular thickening; the tenderness over the inner condyle rather less. The child looks better. Apply blister round lower part of thigh in front.

6th. The pain over the condyle, and the fluctuating swelling, appear less; but as now the periarticular tissues are implicated, I desire to treat, also, that condition. Gave the child chloroform, and applied the cautery-iron in one line at the outside, two at the inside of the joint.

20th. Child is better; the wound from cautery almost healed, and much less tenderness about the joint. To take one tablespoonful of quinine mixture three times a day.

17th Aug. The joint has been strapped tightly for the last ten days, and the splint removed; and the child does not now cry at night; the inner condyle seems scarcely, or not at all, more susceptible of pressure than that of the other side, and the periarticular fulness has disappeared.

Sept. 19th. The child's joint perfectly sound.

Case LII.—Jane Dickery, aged 13, a thin, weak-looking child, having finely-cut features, small bones, and veins plainly marked about the mouth and temple, was brought to me 30th May, 1860, with the left shoulder painful and swollen.

The swelling is very evident; it makes the shoulder look rounder, larger than the other, and somewhat pointed in front, and a little to the outer side. This is best visible when the patient sits upon a low seat and the surgeon looks down upon her from above; he then gets much the same view as is given in the accompanying drawing, which was taken with the child lying on her back. The shoulder is tender on pressure, and hot. She was ordered a teaspoonful of cod-liver oil, and two tablespoonfuls of quinine mixture, three times a day; a blister to the front of shoulder; the arm to be bound to the side.

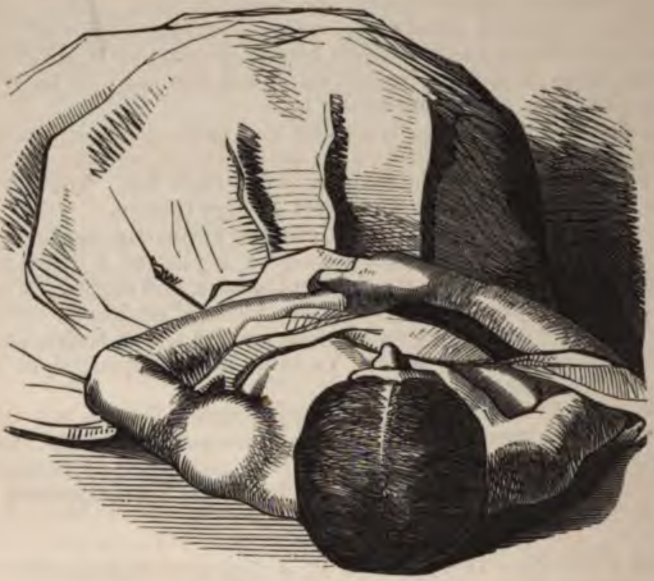
9th June. Appetite improved. She has had, since last report, a blister behind the shoulder; there is a superficial abscess forming over the acromion of the other side.

16th. Again a blister to the front of the shoulder; to be dressed with oxide of zinc ointment. The following to be taken with the cod-liver oil thrice a day:—

℞. Quinæ disulphatis gr. ij.
Ferri sulphatis gr. ij.
Acidi sulph. dil. ♏x.
Spt. ætheris chlorici ♏vii.
Aquæ ℥j. M.

30th. Better; the abscess over the right acromion has broken and left an ulcer; it is quite superficial; to let the blister heal; the arm need not now be bound to the side, but is to be kept in a sling.

Fig. 19.



Strumous osteitis of the head of humerus.

July 13th. The shoulder has diminished in size very much; it is not now tender, nor hot. Passive motion and friction.

Sept. 7th. There was some trouble in overcoming the stiffness, and difficulty in moving the shoulder: but it is now as freely movable as a healthy joint, though the head of the humerus has not regained its normal size; it is but little larger than normal. I procured an admission for her to the Walton Convalescent Hospital.

Case LIII.—I was asked on 28th June, 1860, to see Master F., aged 13, who had been suffering four years and a half from knee-joint disease. He is pale, thin, and dark; has slight ashen discoloration about upper lip.

The disease began, the mother and boy both affirm, by a fall, though they acknowledge that the fall was not remembered till after the disease had begun. The first commencement was pain at the inner condyle, which prevented the boy's walking in the day and sleeping at night; after a time this pain, under treatment, disappeared, and came on again three years ago. As nearly as I can determine by questioning, startings came on nine months ago; they are now so bad that he hardly gets any sleep, and often when he is reading or otherwise amusing himself in the day, there comes one of the starts so violent that it incapacitates him for a time from all employment. He has been taking a grain of opium, of late, every night;

it does not make him sleep better, but renders him more drowsy in the morning.

The knee is swollen and puffy; the swelling does not, however, hide the form of the bones altogether; it is the most prominent over the inner condyle, which projects considerably, and where hard effusion can be felt nearer the skin than elsewhere; there is an abnormal amount of fluid in the joint, but the swelling is not due to that cause, but to periarticular enlargement. A sinus, near the lower and inner edge of the patella, leads into the joint; no rough bone can be felt, but there is no doubt that the inner part of the femur, at least, is carious. The leg is bent at less than a right angle.

I gave an unfavorable prognosis, but agreed to do what was possible. The solid opium was omitted, and instead the following draught at night:—

℞. Chloroform ♏ij.
Acid. hydrocyan. dil. ♏ij.
Træ. opii ♏x.
Træ. aurantii ʒij.
Aquæ destillatæ ʒiss. M.

Two tablespoonfuls of the mixture three times a day:—

℞. Quinæ disulphatis gr. ij.
Ferri sulphatis gr. ij.
Acid. sulph. dil. ♏x.
Træ. aurantii ʒj.
Chloroform ♏j.
Aquæ destillatæ ℥j. M.

The joint was strapped and the leg tightly bound on a splint, with a screw at the back, that it might, if possible, be got a little straighter.

7th July. He has slept better of late, and the starting is less; this may be partly attributed to the strapping, but it is impossible to make the knee in the slightest degree straighter by the screw without producing great pain. To-day chloroform was administered; I divided the necessary tendons and fasciæ, and straightened the joint; ordered cold lotions to be kept on the joint. Let him, immediately (5 P. M.), have ten drops of laudanum, and let the draught to-night contain twenty drops, instead of only ten drops of that tincture.

1st Aug. Not a bad symptom showed itself after the operation; a splint was applied three days after its performance; the slight swelling that came on disappeared under strapping; the starting pains have returned and are now severe; they did not commence to increase till a fortnight after the joint had been straightened; the extending splint was carefully applied and bandaged to the limb.

Sept. 14th. The starting pains began to decrease from the time when the extending force was applied; in five days they had quite disappeared. On the 14th of last month, a fortnight after the application of the extending force, the night draught was discontinued. The sinus is closing; I begin to hope that the caries may be subdued. The boy's health is much improved.

Oct. 21st. I have now applied another means of extension by means of splint, consisting of thigh and leg piece jointed together with a hinge (see Chapter XVII.), and have allowed him to move about on crutches; at night this is removed, and the extending apparatus as before applied.

CHAPTER XII.

CHRONIC RHEUMATIC ARTHRITIS.

PATHOLOGY.

THIS disease, since Dr. Haygarth described one of its appearances as nodosity of the joints, has been regarded with much interest by a large number of careful observers. Among the most zealous and trustworthy of the authors on this subject may be reckoned my colleague, Mr. E. Canton, of the Charing-Cross Hospital; Mr. Robert Adams and Dr. Smith, of Dublin. The malady is, in general, either a sequela of acute rheumatism, a result of exposure to cold, a gouty diathesis, influenced by some cachectic condition of system; or it may be traceable to uterine disorder, and is combined with either luxurious or very scanty feeding. Sir B. Brodie observed it among the upper servants, hall porters, and tall footmen, of large London houses: Mr. Adams, among the damply-lodged and potato-fed peasants of Ireland: it is also a very common disease in Holland. As far as I am aware, it does not exist in hot dry climates. It rarely attacks one joint alone; but generally invades them symmetrically, picking out the same articulation on either side in succession, until a large proportion of the joints of the body are rendered fixed and useless. Sometimes the disease affects only one joint, being produced by accident or other cause. Such a circumstance very rarely happens, except at the hip, where it has acquired the name of Morbus coxæ senilis, Coxitis sicca, &c.[1]

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[1] The partiality of this malady for the hip is undoubted, although it does not apparently tend to affect the larger more than the smaller joints. Mr. Canton, in speaking of this fact, says "the minutest examples in the body may, I believe, succumb to the inroads of this malady. I allude to those of the *ossicula auditûs*, and hence the power of hearing may be diminished or lost. On this latter point, however, I merely surmise; but analogical considerations support the probability." (*Canton's Surgical and Pathological Observations*, p. 2, 1855.) The justice of this surmise is singularly shown in the recent work "On Deafness," by Mr. Toynbee, wherein he has adduced a number of examples of this disease affecting those small joints, p. 276, 1860.

This is in accordance with all our ideas of a constitutional disease, and the peculiarity of the changes, which the parts undergo, strengthens still further such an opinion. The morbid actions are never found confined to one structure; but are, summed up as shortly as possible, these: the joint-bones are flattened, that is, increased in circumference and lessened in capacity; the surfaces are void of cartilage; the bone polished; the articular facets surrounded by large stalactitic osteophytes; the inner surface of the synovial membrane is hirsute, with hypertrophied fringes,[1] which contain false cartilages, or bony growths; the subsynovial tissues are enormously thickened, and frequently contain semicircular pieces of cartilage, or of osseous matter.

It is undoubted, that the first perceptible symptom in the living subject is effusion into the synovial membrane of the joint, a condition in its appearances exactly similar to hydrarthrosis; and if we have an opportunity of examining, after death, a joint in these early stages, we shall, as Mr. Robert Adams has remarked, "find the morbid appearances of the disease formerly called Hydrops Articuli." It nevertheless is a subject of little doubt, in my mind, that the morbid action does not begin in the synovial membrane, but in the bones; that it is in reality a rheumatic osteitis. The enormous changes which we find in the shape and condition of the joint-ends are more than could be produced by a mere synovial inflammation; moreover, it is not merely the joint-ends which are changed by this disease, but the whole bone. I have seen the entire pelvis, the whole tibia, and other large bones, altered by this malady. The much greater difficulty and trouble involved in making out an inflammation of the bone than of soft parts, is a reason why the first effect upon this texture should be overlooked; yet, from comparing a large number of specimens, several of which were kindly lent me by Mr. Canton, and by observing the different conditions of parts in various degrees of disease, I have concluded that the following is the true cause of the morbid action.

First, an osteitis, which causes increased density of the bone from thickening of its external shell, and of all the plates of the cancelli—the inflammation does not attack a surface in preference to another part, but invades the whole mass of the bone; its more frequent occurrence at a joint-end is simply due, like strumous osteitis, to the more active and vascular condition of that part. Very soon the textures in the neighborhood of the bone participate in the disease, the periarticular tissues become inflamed, and the action, like all rheumatic inflammations, tends to development of its products; thus these parts become condensed, and even converted into bone. Hence, the large stalactitic osteophytes, the loose bones in the fibrous tissues.[1] For the same reason, although the cartilages disappear, they are never seen ulcerating; on the contrary, they ossify. In early conditions these structures are found very thin and pink; and upon examining sections through cartilage and bone, the articular lamella is found to be changing in character, the black undeveloped bone-cells throwing out canaliculi, and merging into ordinary bone-corpuscles, while osseous matter encroaches on the cartilage. When the whole thickness of this substance is converted into bone there begins a process of wearing away and polishing. The wear, of course, takes place chiefly in the lines of greatest movement, hence there arise ridges and furrows in these directions: those on the hinge-joints are all straight; those in the ball-and-socket joints, curvilinear, and diverging from the centre, like the engine-turning on the back of a watch. The polishing is in part due to friction, in part to a peculiar change in the bone, which has been termed *porcellanous deposit.* Mr. Quekett has very aptly compared this change with the mode adopted by a French polisher to overcome the difficulty in polishing a piece of wood at the ends, where all the fibres abut, and the vessels open: he fills up the spaces with wax, or some resinous substance, which gives the surface sufficient smoothness to accept a polish.[2] On removing thin slices with a saw, and grinding them down on the side formerly attached, so as to leave the porcellanous surface, the Haversian canals will be found occupied by badly organized calcareous matter, which seems in some instances so rapidly deposited that it strangles the vessels, stagnating their contents, so that the whole surface is stained of a yellow or orange color.

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[1] The sheaths of neighboring tendons are also frequently thus roughened.

At a certain period of the inflammation the thickened and condensed bone becomes gradually lighter. It is the quality of all inflammations first to cause induration, then, as nutrition decreases, softening, or a similar act. The bone does not become soft, but rarefied; when in this state it is dried and sawn through, it is found to contain a quantity of a very peculiar powder, each grain having a remarkably definite size and shape—these particles are ossified cells. It is impossible to trace the development of these bodies; they may merely be the cells of the medulla that have been thus changed; but I rather believe them to be the cells which were contained in the lacunæ. The external shell of the bone and the walls of the cancelli have now become thinned instead of thickened, and examination by the microscope shows them to be very plainly laminated; in fact, they look like a collection of ossified fibres, among which very elongated and narrow lacunæ are placed. The gradual rarefaction of the bone, and the thinning of both external and internal lamellæ, are due, I believe, to the slow ossification of the bone-cells, which starves the intercellular osseous material, and allows its gradual absorption. Hence the peculiar action, termed Osteoporosis—enlargement of the Haversian canals—produced by absorption of the bony lining of those channels. Even the osteophytes, which at first are solid and thick, become mere cases of thin bone, divided in their interior into spaces by slight cancellar plates. But while this rarefying action goes on where the osteitis is old, new indurating material is (as in all except diffuse inflammations) deposited around the focus of inflammation, *i. e.*, in the newly inflamed parts, and to these two simultaneous processes the change in shape of all the articulating surfaces is due, the heads of the bone become flat and broad, while a similar change takes place in all the cavities, glenoid, acetabular, &c.

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[1] "Additamentary Bones." R. Adams.

[2] I am indebted for this paragraph to Mr. Canton's Surgical and Pathological Observations; also to Mr. Quekett's Histological Anatomy.

It is to be observed that the immobility of the joints does not result from anchylosis, an action which does not, as far as I am aware, ever take place in this peculiar form of disease. This condition is produced by the great development of osteophytes, which, sprouting out close to the joint surfaces, act as buttresses, preventing motion by the contact of those springing from one bone with those arising from the other.

There are some minor but curious points worthy of mention: one of them is the ultimate absorption of certain parts of the fibrous tissues. This appears due to the pressure exercised by the new bony growths; thus the capsules of the hip and shoulder, the ligaments of the knee, the biceps tendon of the arm, are frequently found absorbed; this latter is also sometimes displaced inwards by the osteophytes sprouting up beneath it.[1] Another point which I desire to notice, but whose complete investigation must be left to subsequent examination, is the connection between a hirsute condition of the synovial membrane and a rheumatic inflammatory state of the neighboring bone. In those autopsies, in which I have found the synovial fringes hypertrophied, the bone has been thus altered; chiefly very much condensed; the cartilages very thin (undergoing ossification from the deep surface) and pink. Be it observed, that in farther advanced stages these enlarged processes arise from among the irregular chasms left in the changing bone. That there is some connection between hydrarthrosis, with change of structure of the synovial membrane, and chronic rheumatic arthritis, can hardly be doubted; but that the former is a mild and merely local manifestation of the latter disease would be, in the present state of our knowledge, rather too hazardous an assertion.

SYMPTOMS.

The malady commences with pain, which comes on at night, is vague and uncertain, and with stiffness, chiefly felt in the morning. when the person begins to move, and decreasing on continued motion. After fatigue, a fixed pain is felt in the joint, which, on repose at night, yields to the more vague and uncertain aching. Soon an effusion of fluid takes place into the synovial sac, causing a more or less amount of hydrarthrosis (refer to Chapter VII. for a description of hydrarthrotic swellings), which in superficial joints may be distinguished by their peculiar shape as well as by the absence of acute inflammation. Shortly after this tumefaction is manifested the surgeon will feel in certain parts of the swelling a peculiar rustling on pressure; the word rustling is the only one which appears to me properly to designate the sensation, which does not amount to crepitation. It is, of course, only in superficial joints and in parts of the synovial membrane, close to the skin, that this feeling can be detected. Thus, if the malady be at the knee, this rustling can be felt over the inner, sometimes over the outer, part of the head of the tibia, and unless the sac be very full in the subcrural pouch. I found it once in a finger, and once between the inner condyle and olecranon; I have two cases at the present time[1] of knee-joint disease under my care, in which it is found; one is a case simply of hydrarthrosis; the other has already advanced beyond this point. The sequel of events may stop here for many months, perhaps years. Even altogether, particularly if the disease be located in one joint only; or it may go further, and produce, besides the swelling, a very strange species of deformity, which is characteristic of the disease—a deformity produced by a peculiar twist of the bones. The humerus, if the disease attack the shoulder, is projected slightly forwards, everted, and adducted; its head is very prominent in front, deficient, absolutely leaving a hollow, behind. In the hand such a quantity of deformities are produced, that I will only attempt to describe the most striking. It is more frequently attacked than any other member, probably on account of its exposed condition. The first deformity, beyond mere swelling of the synovial membranes, is a remarkable hollowness at the dorsum, about the base of the metacarpal bones, with a singular prominence of the ulna and radius, chiefly of the former; soon the metacarpo-phalangeal joints are involved, and, as each is attacked, the finger becomes greatly adducted and bent a little backwards, so that the forefinger, generally the first attacked, crosses the others on their posterior aspect. The disease at the hip-joint causes shortening and very great eversion of the limb; more than is produced in other hip-joint diseases, more even than follows fractures of the cervix femoris. The tibia, when the knee is affected, gets a peculiar outward tendency, making the knee fall inwards, and at the same time it is rotated outwards. The patella is turned outwards and lies on the outer condyle. It is curious that the wrist should be so greatly, the ankle so little subject to the disease. Mr. R. Adams says: "The ankle-joint is very rarely affected by chronic rheumatic arthritis."[2] When it is attacked, the tarsus is nearly always involved. The scaphoid bone and head of the astragalus rise up in the dorsum, while the sole of the foot becomes depressed and flat; the toes, when the tarso-phalangeal joints are affected, turn outwards: the great toe is usually first and most implicated; it lies crossed over and on the back of the others.

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[1] For the morbid anatomy of this disease as occurring in special joints, the reader is referred to Mr. Canton's work already quoted, and to Mr. R. Adams' admirable and detailed monogram "On Rheumatic Gout."

Combined with this deformity of position is a change in the shape of the joint-ends: the small and superficial ones become irregularly knotty—nodose, as Haygarth called it; the larger ones change in various ways it would lead us too far to describe. At the same time, there comes on remarkable spasm of the muscles, accompanied with wasting; this symptom is variously connected with the deformities above described; both usually come on together and continue, *pari passu,* throughout the disease. Sometimes, on the contrary, the spasm and violent starting pains at night precede every symptom except the vague aching already mentioned. Again, hydrarthrosis, with structural change of the synovial membrane, may last a certain time as the only morbid condition. After a while starting pains will come on. If this be the case, we may rely upon this symptom as showing that changes in the shape and condition of the bone are about to follow.

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[1] 1860.

[2] On Rheumatic Gout, p. 250.

When the malady has continued in a joint for a certain length of time the surgeon will find that it crepitates upon movement. When this symptom first comes on, it is usually pretty distinct, even audible; but if the joint be subjected to much motion it becomes less and less marked, yet will always be present as long as the articulation is not altogether fixed.

I have, contrary to usual custom, deferred speaking of general symptoms, until the local had been discussed. There have been several reasons for doing this, clearness of comprehension being more valuable than mere form. The general health is in these diseases frequently remarkably good; sometimes it appears as though the malady arose from superabundance of animal and digestive powers: the sleep is sound, complexion fresh and rosy, skin soft and moist, appetite perfectly good. We may find that in some of these functions a little superabundance prevails—somewhat too much food and too little work—such cases seem to have been those Sir B. Brodie chiefly observed. We find, on strict inquiry, that there is some acidity and flatulence, and a great tendency to sleep after meals, a loose condition both of muscles and skin, a tendency to accumulation of soft fat, and a greasy, unctuous condition of surface. Such state of comfortable functional performance may continue to the very end of the disease, even when the patient is set fast and incapable of moving any joint in the body. I occasionally am called to see a lady, the joints of whose lower jaw, one shoulder, and perhaps one or two of the vertebral articulations, are the only ones unaffected; the hips and knees are perfectly fixed. In one arm and hand there is sufficient movement for her to feed herself; she is every morning lifted out of bed into a chair, every evening back again to bed, without altering the angle of the thigh and body, or of the knees. Yet she enjoys, as far as the performance of all bodily functions, except movement, is concerned, perfectly good health, with the exception of slight acidity after food.

Other cases present at their commencement another extreme of weak functional performance. The attack will have begun sharply, perhaps with an acute rheumatism, or after long exposure to wet; the strength will be a good deal broken, the health "pulled down." The acidity, which is generally present, is rather from an atonic than from an overworked condition of stomach. The attacks are more painful in this form of disease than in the one just described: the starting pain is more severe, and the sleep less good. The patient wastes more rapidly; but even in these cases the amount of systemic symptoms is very small in proportion to the great local alteration produced by the disease.

TREATMENT.

We have already, to a certain extent, considered the constitutional treatment of rheumatic joint diseases (Chapter VI.); but we then were speaking of a malady which, although essentially chronic, suffers stages of exacerbation, rendering it altogether more acute than this remarkably slow disease.

So insidious is the first attack, that the patient frequently does not come under the surgeon's notice until at least one of the joints have become much altered in form, thickened, and probably so far changed, that we can never hope to restore it to its normal condition; and, indeed, in such cases, when the constitutional evil has firmly fixed itself in the habit, any treatment is placed at a great disadvantage. Dr. Haygarth observes, that it is in the early stages that we can hope to prevent the ravages of the disease, and exhorts the sufferers to seek medical assistance at the first appearance of the malady.

We are bound, however, to admit that the result of treatment is less satisfactory than could be wished. Sometimes a patient, during the use of a particular drug, appears to get better, to lose many of the pains which are so distressing; the joint, even, will become less nodose and irregular: such a medicine is the Iodide of Potassium. In one case that I saw in the early part of the winter 1859, this drug had the most marked effect in procuring ease; after the second day of taking it the patient told me she slept better than she had done for years. In other cases the remedy quite fails to make the slightest difference, either in the progress of the disease or the comfort of the patient. Bichloride of Mercury alone, or with Iodide of Potassium, is often decidedly beneficial for a time; it must not be pushed far enough to affect the gums, or even to approach such affection.

Colchicum is a two-edged sword of considerable sharpness; there is no doubt of its great power in checking gouty and even rheumatic pains; but it is very questionable whether it does so in a beneficial manner. The late Dr. Todd believed that it changes the common acute form of gout into an asthenic condition which is less easy of management; and there is great reason to believe this idea correct. Any practical opinion which is the result of experience, not of mere *à priori* reasoning, deserves great attention; and we may be sure of this fact, that whatever the *modus operandi* of the drug may be, it hastens relapses, renders each one less amenable to treatment, and requiring larger doses of the medicine (if treated with Colchicum) than its predecessors. Whether the remedy act simply as a purgative or as stimulating the liver, or as causing a larger excretion of lithic acid, is not certain; but it is only permissible, when the constitution is vigorous, and should not be given except when other means of procuring ease have failed. I have been led to believe that the liquor colchicinæ prepared by Mr. Bastic, of Brook Street, is less potent for evil than the ordinary preparations of the "Pharmacopœia." The medicine should excite bilious evacuation, but should never be pushed so as to purge; when it acts in that manner its injurious effects will soon manifest themselves.

Guaiacum is a far more reliable medicine, and the best effects may be seen to follow its administration in such doses as shall procure two free bilious motions in the twenty-four hours, if the patient be strong; and in a weaker person equal advantage is produced by giving the medicine in smaller quantities.

The acid state of the primæ viæ is in some way closely connected with the morbid condition of system, and this ought to be combated by some alkali given two or three hours after food, as ammonia or potash (a combination of the two is better than either alone);[1] magnesia in such combination is also useful. It is desirable to act upon the skin, and to endeavor in that way to get rid of the *materies morbi.* In truth, it seems as though want of cutaneous excretion were in great part a cause of the whole class of rheumatic disorders (p. 78). For this purpose the James's powder, or better, the Dover's powder, or a combination of antimony and opium may be used. Ammonia in various forms may also have its effect. The greatest reliance, however, is to be placed on different forms of bath; and upon the internal and external use of certain natural mineral waters, both English and Continental.

The mere hot-water bath is the least efficacious form of artificial bathing. The vapor and lamp-bath for those who cannot conveniently be moved, or for whom the more active sort are too violent, produce great cutaneous transpiration, and, if persevered in, have very considerable effect in recent cases, where the alteration of tissue is as yet slight. The hot air and the Turkish bath[2] are, however, more commendable as producing greater action with less debilitating effect; they are nevertheless to be used cautiously.

The mineral springs of England, which have the most power in altering the constitutional conditions upon which this form of rheumatism depends, are Buxton and Bath; the former is adapted to those cases in which some febrile disturbance is still going on, and particularly if bilious derangement be present; the latter is more active and tonic (the water contains iron) and must be used with more caution; but when all febrile disturbance has ceased, and when neuralgic symptoms also prevail, the Bath waters are preferable to those of Buxton.

Of the foreign springs, those of Aix, Carlsbad, and Wiesbaden rank according to the order in which they are enumerated. Many patients cannot, upon first resorting to such treatment, bear the powerful waters of Wiesbaden, and should first undergo a fortnight or so of the treatment at Aix. A case has come under my observation of a gentleman whose finger-joints and one knee were rapidly becoming stiffened, although it is probable that no actual osteophytes had formed; for the affected parts have regained their normal condition. He has now spent six weeks or two months, during each of the last three years, at one or the other of those places, beginning with the milder and ending with the stronger course. Another, who was extremely rheumatic, being confined to his house generally a fortnight or more once or twice during the winter, has avoided these attacks by spending the autumn at one of the spas above mentioned.

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[1] Mr. R. Adams speaks strongly in disfavor of soda, because, as he says, in the state of system the combination of lithic acid with the soda would tend to produce the chalk-stone. It is to be observed, however, that lithate of soda is not deposited among the tissues in this disease.

[2] For some considerable time past it has been my habit to recommend patients with gouty or rheumatic diseases to use the Turkish or other form of bath. Lately these establishments have come a good deal into vogue, and are now being used indiscriminately, and in several cases, I believe, injuriously.

The use of all these means must be continued regularly and perseveringly for some weeks. The artificial as well as natural hot baths frequently act, at first, by increasing the pains[1] and setting up a little febrile action. Such effect should, however, be slight and continue only for a short time; but it is well that the patient be made aware of the fact, lest he should imagine that the treatment have been injurious. The medical attendant must see that these first effects do not overstep a certain limit, and must be careful to modify the mode of bathing or to discontinue the treatment if necessary.

We cannot tell why natural hot springs should be so much more efficacious than artificial waters made, chemically, as like them as possible; perhaps change of air, scene, diet, and mode of life may have much to do with this fact.

It is not, however, my desire to place before the reader an exaggerated idea of the benefit such treatment may afford. A spa supports a quantity of hotels, attendants, gamblers, &c. &c.; we hear the successful cases quoted again and again; indeed if we could believe all that has been said and written about many mineral springs, we should only wonder why, with such waters on the earth, diseases should continue to exist. Although it must be acknowledged that many who resort to such places with the hope of coming back sound and healthy, only bring away with them disappointment and regret; yet others are decidedly benefited.

This disease is so slow, and extends over such a long period that I refrain from giving any history of cases.

[1] Some, as Wiesbaden and Bath, produce a slight miliary eruption.

CHAPTER XIII.

INFLAMMATION AND DEGENERATION OF CARTILAGES.

Most works on diseases of the joints contain a part devoted to those maladies which have their especial seat in the cartilages; and yet nothing can be more sure than that of all the joint-diseases, which fall under the surgeon's notice, not one originates in the cartilage. It has been seen that an inflammatory action commencing in the synovial membrane or in the bone, will spread to the cartilage and set up an ulceration of that structure; it is also well known that in the dead-house and dissecting room we frequently find breaches of continuity in various articular cartilages which were accompanied by no symptom during life. The joints in which such conditions are found have been perfectly free from any pain or any diminution of mobility, and the neighboring tissues have been perfectly untouched by any disease whatever. Thus we come to the inevitable conclusion, that disease confined to the cartilage gives rise to no symptoms; and we must ask whether disease, which has commenced elsewhere and passes to the cartilage, may give any sign whereby we can tell whether or no the cartilage be diseased? To answer this question fully it is necessary to enter somewhat deeply into the physiology and pathology of cartilage; but as the subject has occupied some attention in each division of this work, it will be only necessary to revert to the points already treated, and the present chapter will rather be a *résumé* than a full exposition of the subject.

The questions resolve themselves into these: Are there different sorts of ulceration of cartilage; one accompanied, the other unaccompanied, by any symptoms? If so, are either or both these ulcerations produced by some action of the tissue itself, or of some other tissue, absorbing the cartilage as a passive material?

Sir B. Brodie has throughout all the editions of his work on diseases of the joints adhered to his original view of active changes in the cartilages; in his earlier papers he ascribed these to the intervention of vessels; and he has even in his fifth edition some difficulty in getting rid of the idea, since he affirms that "in persons who have not yet attained their full growth, vessels penetrate into the articular cartilage." Mr. Aston Key, however, in 1833, saw some reason to doubt the possibility of any vital actions in cartilage, and attributed their absorption entirely to the "villous processes developed on the synovial membrane during inflammation of that structure." Sir B. Brodie, nevertheless, adhered to his original idea. In 1843, M. Richet,[1] of the Hôpital Bons-Secours, added his testimony to the idea of cartilage being a dead, an almost inorganic material. Dr. Ecker,[2] in 1844, published the first observations upon the actions and conditions of cartilage-cells in disease. One of Mr. Goodsir's "Pathological and Surgical Observations" in 1845, also mentioned the growth and increase in the number and size of the cells. In 1848, Dr. Redfern published a series of careful and minute observations "On the Abnormal Nutrition of Articular Cartilages" carrying further the researches of Ecker and Goodsir, and disclosing many details which those authors had not mentioned.[3] Yet the idea that cartilage is truly a living structure capable of vital action penetrated so slowly, that in 1853 M. Richet, in a paper on white swelling,[4] insists upon the inactivity of cartilage, and is at pains to prove that it is incapable of any independent action, saying, although he refers to Dr. Redfern's paper, "that the only direct manner of proving that cartilages are susceptible of inflammation would be to demonstrate vessels in their substance itself." Mr. Birkett[5] censures the use of the word ulceration, and desires to substitute "disintegration."

Even so late as 1859, Mr. Bryant[6] of Guy's Hospital, following too implicitly in his path, ascribed all the diseases of cartilage to atrophy; degeneration and hypertrophy being only mentioned in order to throw doubt on the possibility of their occurrence.

I believe myself to have been the first to have pointed out that those diseases of cartilage which accompany the inflammation of other tissues in the joint are, in reality, inflammation.[1] The whole view of the subject, and the arguments which irresistibly lead to this conclusion, have been already detailed (see Chapter II. and Chapter V.). Histologically cartilage belongs to the connective tissues, and we have seen abundant evidence of the fact that their inflammation essentially consists in a rapid multiplication of the cells, which form an essential part of their structure. We find this to be the case with the areolar, ligamentous[2] and osseous[3] tissues; indeed, we find that the action of vessels in inflammation is but secondary; they appear only as bearers of an increased supply of nutriment to tissues making increased demands; hence the one necessary essential which renders it possible for a tissue to assume an inflammatory action, is not the presence of vessels actually in that tissue, but the presence of cells unoccupied by any material which might prevent their multiplication and generation.[4] Thus, histologically and pathologically, there is no reason why cartilage should not inflame, and in certain diseases of that structure we see the cells assuming a generative activity, which is the essence of the inflammatory act, as exemplified in all tissues of the connective class.[5] Wounds of the cornea, according to Mr. Bowman,[6] produce an abundant generation of cells, which lead either to reunion or suppuration and destruction of the part. Dr. Redfern passed setons through the costal cartilages of dogs, and found that they invariably produced considerable generation of cells in the part next the silk. An examination of areolar tissue in the neighborhood of a wound or ulcer, shows the cells of that structure in an active condition of generation; and the cells in the lacunæ of bone are actively employed in inflammation of that structure. When, therefore, an inflammatory disease of the synovial membrane spreads to the other constituents of the joint, and we find the cartilage and bone involved, we have no *à priori* reason for refusing the term inflammation to the disease of the cartilage, simply because that structure contains no bloodvessels.

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[1] Richet, Sur les Tumeurs Blanches. Annales de Chirurgie.

[2] Ueber Abnützung und Zerstörung der Gelenkknörpel. Archiv. für Physiologische Heilkunde, vol. ii. p. 235.

[3] See my paper On the relation between Synovitis and Ulceration of Articular Cartilages, Edinburgh Medical Journal, February, 1860.

[4] Mémoires de l'Académie Impériale, tome xvii. 1853.

[5] Guy's Hospital Reports, 2d series, vol. vi. p. 237.

[6] Diseases and Injuries of the Joints.

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[1] See my paper "On the Nutrition and Inflammation of Articular Cartilages," in Med. Chi. Review, Oct. 1859.

[2] See my paper "On Granulation," Beale's Archives, vol. ii. No. 5.

[3] See my paper "On Osteitis," in Med. Chi. Review, April, 1860; and Chap. XI.

[4] From this fact a corollary may be drawn; one which on the face of it may appear utterly false, far-fetched, and even absurd; but which I nevertheless believe myself in a position to prove, namely, that no special tissue is capable of inflammation, *i. e.*, that nerve tissue, whether the cellular or fibrous, that muscular tissue, &c., cannot inflame, but that the cases of so-called inflammation of the brain and of muscles are in truth examples of inflammation of the areolar tissues ramifying among these organs.

[5] See my paper "On Granulation," &c., in Beale's Archives of Medicine, No. 5.

[6] "On the Structures involved in Operations on the Eye," p. 29.

A point of pathology cannot, however, be settled by mere reasoning; the morbid anatomy is the only true key to the argument. It is found, then, that multiplication of cartilage-cells may occur to such an extent as to eat up or absorb the hyaline structure, producing ulcers commencing on the free surface of the cartilage. This process takes place when the surrounding structures are inflamed, and is similar to the inflammatory act in them.

But ulcerations of, *i. e.* breaches of continuity in cartilage occur when the parts around are perfectly healthy. The existence of these lesions is not suspected during life; they are found in the dead subject, whose articular functions had been perfect. Such ulcers look to the naked eye more fibrous, rough, and are generally softer than those already described; sometimes the cartilage is converted into a set of parallel fibres, close together, and standing from the bone surface as the pile of velvet from the woof; and often that part of the cartilage is yellow. If sections of this material be examined microscopically, the corpuscles will be found increased in size, and the contained cells also are larger; but they are not increased in number. Those corpuscles which contained two, three, or four cells near the attached surface, still continue, on approaching the other edge, to possess only an equal number of cells; the nuclei do not multiply; on the other hand, they become obscured by an accumulation of minute globules of oil around them, between the cell wall and the nucleus; in a further advanced stage, and nearer the free surface, the corpuscle itself gets filled with the oil, which lies around the cells. The fibrification of the hyaline substance commences by the appearance of thin faint striæ; in some instances there may be seen between these a row of oil-globules, and the striæ become more numerous and more open, until the substance is split into fibres.

This fatty degeneration is a passive disease, and consists simply in the fact, that the cartilage-cells have imbibed material which unfits them for their nutrient function. There is also another form of cartilaginous degeneration—the granular; it has the same effect upon the hyaline substance of splitting it into fibres. Microscopic examination shows that the corpuscles, when thus affected, become minutely spotted with a substance more opaque than the surrounding material; they, at the same time, become enlarged, but very shortly afterwards shrivel, each corpuscle forming a thin transverse scale long before it comes to the free edge; these lines, or scales, appear divided, as though by the old cell-walls, but the usual aspect of the cell and corpuscle is lost.

I consider that the fatty degeneration of cartilage is similar to that degenerate state of the cornea, which Mr. Canton has shown to be the essence of *arcus senilis,* while the granular is comparable to the atheromatous condition of arteries.

In neither of these cases do the nuclei and cells multiply; they simply absorb a morbid material and lose their nutrient power; hence the action in question is a passive one—a mere degeneration. The function of articular cartilage is so passive, and is spread over so large a surface, that we have no means of ascertaining when these degenerative diseases are taking place over a small extent of the tissue; and being but passive changes, they are not accompanied by any hyperæmia, nor by any pain. The ulceration, then, of cartilages may be divided into inflammatory and degenerative, and these latter again must be subdivided. The changes whereon degeneration depends are situated in the cell, and therefore we must class them according to conditions of that body; hence the term fibrous degeneration is false, and the more so as fibrification of the hyaline substance accompanies every morbid change of cartilage. We may therefore divide degenerative diseases into fatty and granular,[1] and as these are mere passive changes, occurring in a structure without sensibility, so they do not give rise to any symptoms.

There is another form of malady resulting from deposit in the cartilage of a morbid material, viz., urate of soda; and it is a form that appears scarcely to belong to the degenerative class. The chalk is deposited actually in the cartilage, *i. e.*, in the hyaline substance around the corpuscle; but the extreme opacity of the material renders it extremely difficult to trace the connection between it and the containing tissue. It soon splits the cartilage into fibres and lies among them, and if the deposit be in any great quantity the fibres almost disappear before it, and the tissue is converted into a layer of chalk-stone, held together by scattered fibres. Sometimes this deposit, or other cause, sets up inflammation, and then the cartilage yields more completely, and the urate is thrown off into the joint, sometimes *en masse*, sometimes mingled with the pus, or synovia, to which, being held in suspension, it gives a peculiar milky color and gritty feel.

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[1] There is no reason to believe that there exists any other form of degeneration of cartilage, although there may be two sorts of the granular type.

Inflammatory diseases of the cartilage only occur when surrounding structures are inflamed. The reason that inflammation of cartilage does not form a primary joint-disease is to be found in the insusceptibility of cartilage to mechanical or other irritation—an insusceptibility which constitutes its great value—and also in its sluggishness of action. Hence, many injuries or irritations may be insufficient to produce primary inflammation of cartilage, yet be amply intense enough to set up synovitis, which may secondarily cause the cartilages to become inflamed. Or, again, an injury may be sufficient to cause primary cartilaginous inflammation; but it must, at the same time, of necessity, be sufficient to produce either synovitis or osteitis, or both, and the actions of either tissue being so much more rapid than that of cartilage, we find these inflammations preceding the cartilaginous disease. The question is not whether cartilage be susceptible of primary inflammation, but whether, under the circumstances in which it is placed, such disease ever presents itself to the practical surgeon. It cannot, probably, be directly proved that inflammatory ulcers of cartilages never take place unless some other part of the joint-apparatus be also diseased; but we know that the symptoms of joint inflammation become greatly worse when the cartilages begin to participate in the action, hence this inflammation is a painful and wearing disease; but we never come across such symptoms unaccompanied, or rather unpreceded, by inflammation of other joint structures.

The inflammation may be, as we have already said, acute or chronic. It consists essentially in the rapid generation of cells from those primarily existing in the structure. When this generation is very quick, it absorbs the hyaline substance rapidly, and an ulcer, with clean-cut edges, is produced; when the action is chronic, the hyaline structure is converted into fibres, which render the edge and bottom of the ulcer rough and uneven. The changes which the cells undergo have been described by Mr. Redfern, who has not, however, separated degenerative from inflammatory diseases.

The first appearance, in microscopic examination of the inflamed tissue, is an increase in the number of nuclei contained in the cells, and in the number of cells in the corpuscle—hence the increase of these bodies in size. In the most acute form of the disease the corpuscles are converted into large conglomerations of cells and nuclei, lying very close together, many of the cells containing two or more nuclei. In the most acute forms this growth is so rapid that it devours entirely the intercellular material, and thus an ulcer is left, with perfectly clean smooth edges. The cells, thus set free, fall into the joint-cavity, and continue to multiply as pus-cells (p. 57). A less rapid cell action leads ultimately to the same result; but the hyaline substance, before disappearing altogether, becomes converted into parallel fibres in the direction of the cell-force.

The chronic inflammation differs from this by the more plastic character of its results. A large number of the cells formed do not simply become pus-cells, but being produced by a slower action have a more persistent character, and a more perfect life. They change into fusiform and into fibre-cells, and thus the fibrification of cartilage is, in such instances, not a mere mechanical splitting of hyaline structure, but is also, in part, an actual production of fibres from cells—the material formed being a coarse sort of areolar tissue, or a fibro-cartilage (p. 121). Much of this growth is not doomed to be persistent, but some of it goes on developing further, while the action increases in area, and at last some of it comes in contact with granulation from the synovial membrane, or from the bone (the articular lamella having in places disappeared). The two parts thus in contact are engaged in identical processes, the formation of fusiform cells into cell-fibres and areolar tissue; they therefore unite, or rather grow together, so intimately that it is impossible to find the boundary between the two structures (p. 123).[1] When a disease stops at this stage, we may find, upon subsequent examination, a partial and false anchylosis; that is, there will be anchylosis in some parts, sound cartilage in others. Sometimes chronic ulcers, if small, leave behind simply a cicatrix, like a scar in any other tissue. These marks in cartilage are always the result of a very slow inflammation; a more rapid action, instead of converting the cells, their progeny and the hyaline substance into fibre and areolar cells, causes them to disappear, leaving a breach of surface which is not filled up by any scar.[1]

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[1] It was this condition which led Mr. Aston Key to conclude on the destruction of cartilages by growths from synovial membrane.

When the primary attack is an osteitis, the cartilage undergoes the processes both of degeneration and inflammation. In articular diseases thus commencing it is to be remembered, that generally only one of the bones forming the joints is primarily affected; moreover, it is seldom so extensively diseased that the whole surface, whereon the cartilage rests, undergoes morbid action at the same time. Now, the first effect of an osteitis upon the cartilage is, in most instances, a cessation of its supply of nutriment, hence a rapid degeneration and detachment, with its articular lamella, from the inflamed portion of the bone. Around the spots where such degeneration takes place, the cartilage will not thus be killed, as it were by starvation, but will become inflamed and ulcerated. The cartilages covering the bone, which still remains normal, will, when the other joint textures become inflamed, participate in the inflammation, just as they do in a synovitis. Thus, in articular diseases, commencing in one of the bones, there are two sorts of action going on in the cartilages—inflammation and degeneration. The latter occurs over that portion of the bone whose inflammation has been so violent as to cut off the nutrient supply, the latter over those portions less powerfully affected, and in that cartilage covering the yet normal bone, to which the action spreads in the same way as it does to the synovial membrane. The cartilage which has suffered degeneration, and which lies over the focus of inflammation, is detached with the articular lamella by the osteitis itself, and is frequently pushed by a collection of pus, or a growth of granulations into the joint-cavity, in which it is found lying loose and fatty, its formerly attached surface feeling gritty like sand-paper, from the adherence of osseous matter.

In the examination of certain joint-diseases, viz., chronic rheumatic synovitis and osteitis, the cartilages will be found to have lost their opalescent appearance, to have become abnormally transparent, of a pinkish brown color, and to be very much thinner than natural. They have in such cases an even surface, except rarely in a few small spots where they may be ulcerated, the ulcers having smooth or nearly smooth surfaces; very frequently a piece of eburnated bone will be found on the same plane as the cartilaginous surface. I believe this condition to be a slow form of inflammation, tending, like other processes of rheumatic origin, to the completion of all the parts involved. The attenuation, I believe, takes place, not from the free but from the attached surface, by encroachment of bone upon the cartilage, and this opinion is much strengthened by the fact, that there seems to be a solid case of bone thicker than usual between the osseous cancelli and the cartilage; moreover, the articular lamella gradually assumes more and more the structure of ordinary bone.

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[1] There is, in the College of Surgeons, a preparation by Liston of an ulcerating cartilage in which vessels ramify. These vessels come from the bone, hence the articular lamella must have been perforated, and if so, the cartilage would have been ulcerated. The vessel would not go perfectly unaccompanied into a channel in cartilage; it must have entered with a sprout of granulation tissue. The preparation is dried, and it cannot now be made out in what structure the vessel really lies.

It is certain, that any tissue endowed with nutrient power must be capable of both hypertrophy and of atrophy, but practically we do not come across such diseases. In young subjects, the cartilage may be found excessively thick, but I have always attributed this to delayed ossification of the epiphysis. In adults, the cartilages may be found slightly thickened, but they are then likewise sodden and soft, and their increase may result from mere passive imbibition of fluid. Still, as above stated, the possibility of simple hypertrophy cannot be denied to a tissue capable of both nutrition and inflammation.

Atrophy of cartilage, as described by some authors, that is considerable decrease in its normal thickness, results, I believe, from encroachment of bone upon its deep surface, as just described. The granular and fatty degeneration is the result of atrophy, and the only undoubted form of this condition.

CHAPTER XIV.

HIP-JOINT DISEASE.

SEMEIOLOGY.

IT may not be in accordance with strict logical arrangement, that one particular joint should be singled out for a special chapter; but it will, I believe, tend to make this book more valuable, if the diagnostic signs of hip-disease be separately discussed. By means of this articulation, the strongest limb in the body is fastened to the trunk itself, and it lies so deep, that at no part can we put our fingers immediately upon or over the synovial membrane, as in every other important joint; and we cannot, therefore, detect fluctuation, changes of shape, or of size, with anything like the readiness with which we can find the like alterations in other and more superficial joints. For example, a strumous synovitis of the knee is often detectable from the swelling, before any pain shall have called the patient's attention to the part; the changes of shape, size, &c. are perfectly distinguishable, and the failure of mobility is easily detected. But the round massive form of the parts about the hips, the difficulty, or rather impossibility, of fixing the pelvis with the hand, the projection of the trochanter, and the bend of the neck of the femur, rendering the true radius of motion very short, the mode in which the whole head of the bone is impacted in the socket, and many other circumstances, throw great obstacles in the way of a diagnosis concerning merely the presence or absence of hip-joint disease, and a minute distinction between the inflammation of one structure and that of another is extremely difficult, in very many cases impossible. The obscurity of the subject is still further increased by the confusion of opinion and description which authors have expended on the question, many of them taking no pains with direct experiment, and very little in pathological research, but giving *à priori* reasonings all the weight and importance of direct facts. Thus the disease has been made to commence in the ligamentum teres, and in the cartilage as well as in the bone and synovial membrane. The symptoms, viz., lengthening, shortening, pain in the knee, &c., have been attributed to almost as many causes as there have been authorities to assign them, and thus the subject is involved in a labyrinth of falsity and conjecture, from which nothing but a simple following out the lead of truth can ever rescue it.

First, as to the structure in which disease of the hip-joint may commence: there can be no doubt that it may begin in the synovial membrane, and in the bone, like other joint diseases; there is no reason to suppose, nor is there the slightest proof, that it may commence in structures, in which diseases of other joints do not begin, for instance, the ligaments. We have seen that when the subsynovial tissues, in which ligaments are placed, inflame, the ligaments themselves suffer, soften, and become thickened or absorbed as the case may tend; we have seen that internal ligaments, as the crucial of the knee, which are surrounded by folds of synovial membrane, and which are in the position of a subsynovial tissue, are more apt to follow quickly in this course, than external ligaments; but the disease is not the less a synovitis, because there happen to be internal ligaments which participate early in the inflammation and become quickly changed or absorbed. How very frequently does it occur in the knee-joint, that the crucial ligaments have entirely disappeared, even in cases of subacute synovitis, where the cartilage is hardly altered, and where the general change in the synovial tissues is but slight! I have also seen the crucial ligaments all but converted into gelatinous structure, their presence being only marked by a few white ligamentous lines, running parallel to each other through the pink mass. In the same way, the ligamentum teres of the hip-joint has been found to be much softened and inflamed, while the synovial membrane around it is red and hyperæmic; but there is no possible reason for assuming that the disease begins in an inflammation of that structure more than in any other part of the synovial and subsynovial tissue.[1] Other authors have located the diseased action in the fat which lies in the bottom of the cotyloid cavity; but this opinion is too antiquated, and too far behind the science of the present day to need serious refutation. Again, the cartilages of the hip are not differently situated to those of other joints in regard to their nutrition and diseases; they are as often, or indeed may be more often than in other joints, the seat of degeneration (p. 290); and in old subjects, in whom during life no symptom of joint disease existed, such degenerative ulcers will very frequently be found; but, except this condition, which does not produce a detectable joint disease, there is no malady of the hip commencing in the cartilage, any more than there is a malady of other joints beginning in that structure.

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[1] Mr. Aston Key unfortunately adds the weight of his authority to this fallacy; he gives an account of a hip-joint in which he finds the whole synovial and subsynovial tissue inflamed, and among it that portion which envelops and in part constitutes the ligamentum teres. He says "the cases which it has fallen under my lot to examine have induced me to believe that ulceration of the cartilage is preceded by inflammation of the ligamentum teres." Med. Chi. Trans., vol. xviii.,

Thus we come again to the two tissues, viz., synovial membrane and bone, whose inflammation is, as we have seen, the cause of disease in other joints; and I am sure of truth in asserting, that every hip disease commences in one or other of these parts. It is, however, a matter extremely difficult—often, I believe, in practice impossible—to decide whether a disease already somewhat advanced may have been originally synovial or osseous; as may be supposed from the fact, that some men of great experience and care, have asserted that *all* hip-joint diseases begin in the bone (Rust, of Vienna, held this opinion), while others have as positively affirmed, that *all* such maladies commence in the synovial membrane. In the earliest stages of the disease, we are able to conclude with tolerable certainty concerning the structure in which it is situated during the patient's life, and on examination, pathologically can always ascertain the fact; but if the disease have advanced to the second period, the attempt at diagnosis on the living patient will be vain, and the anatomical examination even will very frequently lead to no positive conclusion. In order to point out distinctly the difficulties in such minute diagnosis, and to place the whole truth before the reader, it will be well to enter minutely into the symptomatology of the disease, and to trace where possible the cause of each separate symptom: in doing so, I will endeavor, to the best of my ability, to make a clear and broad distinction between what is absolute fact, and what is mere conjecture. The pathology of the synovitis or osteitis will not be again broached; we have now

p. 230. We need not here enter into the general relationship between ulceration of cartilage and inflammation of synovial membrane: the same words of course apply to this as to other joints.

only to do with the symptoms and their corresponding morbid anatomy.

First Stage.[1]—The beginning of hip-joint disease is marked in children, who do not and cannot express all their sensations, by slight limping, during which the knee is somewhat bent, and the foot turned either inwards, or more commonly outwards. In adults, the disease commences by a sense of fatigue, or of actual pain, the more readily remarked, that it is only situated in one hip. At this period, and for a short time afterwards, there appear certain symptoms in some cases, which are absent in others, and which may enable the surgeon to define the synovial or osteal locality of the disease. Pain, tenderness, swelling, heat, more or less immobility, are, at this stage, all we can fix upon as indications of the disease, and it is to the variations of these symptoms that we must look for our means of distinguishing the one form of malady from the other.

Synovitis.—Pain includes all the different dolorous symptoms produced by the disease, whether they occur in the hip itself, or in other parts of the body. The pain of chronic synovitis may, in the hip as in other joints, be absent during the first days of the disease; but when it comes on, it is continuous, and more severe after exercise. Limping in children, which is produced by the pain, may be observed to have the following periods of greatest intensity. In the morning, on first rising, there is some lameness, which goes off entirely in the earliest beginning of, and only partially a little later in the disease. Towards evening, or after any continuous exercise, limping returns, and is more marked than in the morning, and becomes more and more so as the day goes on, or fatigue increases. In older persons, who can define their sensations, stiffness is complained of in the morning, while in the evening, or after long exercise, pain more or less acute, with a sense of fulness and distension, is felt.

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[1] Brodie, in his admirable work "On Diseases of the Joints," has not given a special division to morbus coxæ, but describes it with other joint-diseases according to the anatomical seats of the malady. Ford, whose "Observations on Disease of the Hip-Joint," 1794, has been a sort of unacknowledged loan-office for many subsequent writers on the subject, is the first surgeon who makes three periods in morbus coxarius. He does not say in so many words that he divides the malady into three stages, but he gives a description of three successive periods. This division is of the greatest importance. His first stage extends from the commencement of the disease to the first appearance of lengthening of the limb; the second stage reaches from this occurrence to the supervention of marked shortening, either from dislocation or other cause; the third, beginning with this shortening, goes on to the end of the case. Boyer and Maisonneuve take two stages, the first extending from the commencement of the disease to dislocation of the head of the femur. Rush makes four: first, the commencement; second, lengthening; third, shortening; fourth, suppuration. Chelius (South's Translation) divides the malady into the first three of Rust's sections. We will adhere, more or less closely, to Ford's divisions; but he has hardly made them sufficiently definite, and it is a defect which shall, as far as possible, be supplied.

With this, there is tenderness on pressing at the back of the trochanter, and tenderness at the groin; but pressing the trochanter inwards, so as to bring the head of the femur and the acetabulum into close contact, does not cause pain. There is not in this early stage of synovitis any pain in the knee. There are none of those startings that wake up the patient at night with a great dread.

As these symptoms come on, they are accompanied and followed by a certain amount of swelling in the groin, and behind the trochanter. The former of these tends to obliterate the fossa in that situation, or at least to render it narrower by an apparent increase in breadth of the posterior part of the trochanter. This, in its early condition, will only be seen when the patient, placed with the back to a window, permits equally oblique light to fall on both hips. The swelling in the groin is both more visible, and more easily felt; it lies of course below Poupart's ligament, is deep seated, has an even surface, and must not be mistaken for enlarged glands. Be it remarked, that when this swelling in the groin becomes easily perceptible, sympathetic pain in the knee usually supervenes. Increased heat at the part, chiefly noticeable at the back of the trochanter and at the groin, comes on with the swelling.

Osteitis.—Pain, in and about the hip-joint, is of a heavy, dull aching character; it is not increased by exercise, but is generally most severe in bed at night; there is no stiffness in the morning. The pain is often irregularly remittent, being continuous for three or four days and nights, and then disappearing for a time. In children, a pale, worn, weary look will be observed before any limping actually comes on, and the child will sleep badly at night, cry perhaps if laid on the diseased, but as yet unsuspected, side. The signs of pain, as well as the worn look in children, come on before any limping; in older persons, pain is complained of before such a positive symptom is perceived; the limping, when it once does come on, is equable throughout the whole day. There is no tenderness while pressing behind the trochanter; nor, unless inflamed by other causes, over the groin. We shall see directly that certain circumstances change this condition. There is early pain in the knee, startings at night may come on in this, the first stage of the disease, and tenderness on pressing the joint surfaces together is not uncommon.

With these symptoms, there is no swelling either behind the trochanter, or deep in the groin; the glands of the groin, however, are frequently enlarged; this is a point which should have great weight in forming the surgeon's opinion, and is the cause alluded to in the last paragraph, as influencing tenderness of the groin on pressure. There is no increased heat about the part. Add to these local signs, that a child in a very cachectic condition from struma is more liable to be attacked with osteitic than with synovitic hip-disease, and the fact of the general health failing in a manner still more marked, before any lameness is perceptible.

A long series of careful observations has convinced me that this account may be relied on wherever the semeiology is sufficiently marked. To render this more distinct, I will tabulate the symptoms of the first stage.

Synovitis—Symptoms.	*Osteitis—Symptoms.*
The pain is a sense of fulness, distension increased in evening, and after exercise, but constant.	Pain, dull aching; most at night in bed; remittent.
Stiffness in morning.	No stiffness in the morning.
Limping comes on with the pain. It is at first slight in morning, then disappears, and is more marked in evening.	Limping does not come on till after the pain has existed some time, then is equable throughout the day.
Pain in knee does not come on till after the deep swelling in the groin is perceptible.	Pain in the knee an early symptom.
Starting of the limb a late symptom.	Starting of the limb an early symptom.
Tenderness behind trochanter, and at groin: none on pressing articular surfaces together.	No tenderness on pressing behind trochanter and groin, but sometimes on pressing joint surfaces together.
The swelling in the groin is deep, and below Poupart's ligament; the glands there do not swell.	The glands in the groin swell before any deeper swelling is perceptible, if ever such come on in the first stage.

Nothing can tend more effectually to throw undeserved doubt upon facts than straining them beyond their legitimate application;

and I would deprecate as strongly as possible any attempt to press the above diagnostic difference into cases, that have advanced beyond the first stage, or even towards the latter end of that period. As the disease proceeds, the clearness of the symptoms becomes obliterated; the limping in either case is continuous: there is tenderness both behind the groin, and on pressing the joint surfaces together; and starting at night, if previously absent, will come on. The whole train of symptoms may have continued an indefinite time, for *morbus coxarius*, like all diseases, has an acute and a chronic form: the acute malady may gallop through all the variations of the first stage in a few days, or even hours; the chronic may continue for months as so slight a disease in appearance, that it is scarcely regarded; until the more serious symptoms which immediately precede and lead to the second stage supervene.

The Second Stage consists of lengthening of the limb; flattening of the nates, with a lateral twist of the spine; constant and strongly marked lameness; a more or less continuous pain in the hip and knee; spasmodic pains at night in the limb, beginning about the hip and upper part of the thigh ending at the knee; contraction of certain muscles and wasting of the limb. In this period of the affection we have no longer anything to do with detecting in which structure the disease commenced, but have simply to observe the symptoms of the malady. Those which had been increasing towards the latter end of the first stage, viz., pain, both at hip and knee, tenderness, swelling, and limping continue, and there is added another symptom, viz., posture. The thigh is constantly flexed upon the abdomen, more or less in different cases: the knee is generally rotated outwards, and the foot everted. If the patient be made to stand up, he bears all the weight of the body upon the sound limb; the knee of the diseased one will be in a plane in front of that of the other, in consequence of the hip being flexed, and also in consequence of a malposture of the pelvis, shortly to be described, it (the knee) will be also separated from its fellow, *i.e.*, abducted; the foot will rest with the sole upon the ground, a good deal in front, with the toe usually turned out, though it will sometimes be turned in.[1] At the same time, the knee of the affected side becomes lower than the other; that is, the thigh appears lengthened. The buttock of that side is flatter, the folds of the nates longer and less marked than normal, the depression at the back of the trochanter nearly obliterated. (See Fig. 20.) The appearance of lengthening in the limb is the symptom, *par excellence*, which marks this stage of the malady. Much thought, and more writing, has been expended in endeavoring to account for this apparent increase in the length of the limb. Most English, and some Continental, authors refer it entirely to position; others believe that a real lengthening may take place, that is to say, they believe that the head of the thigh bone may, without dislocation, be projected sufficiently far from the pelvis to cause the whole distance between knee and acetabulum to be increased. I am, from the results of experiments, able to affirm, that real increase in this distance is without dislocation downwards utterly impossible.[1] The position whereby apparent lengthening in hip-joint disease is obtained is a twist downward and forward of the affected side of the pelvis; the thigh is flexed upon the body, abducted, and rotated outwards.[2]

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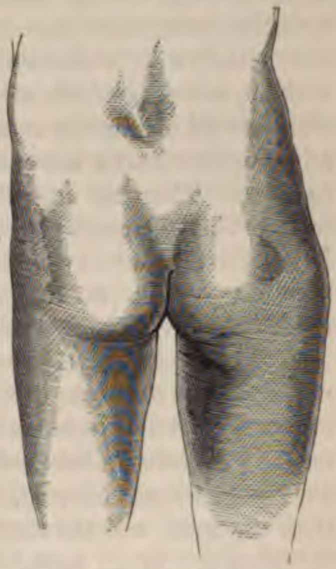
[1] I have seen this position twice, both times in young children.

Fig. 20.



Hip-disease—The position of apparent lengthening.

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[1] These experiments and the opinions of certain authors are, in order to leave the course of our narrative uninterrupted, placed together in an appendix to the present chapter.

[2] M. Bonnet has given at great length an analysis into all the varieties of position which the thigh may assume in hip-joint disease; but not perceiving the practical value of such minute distinctions, I shall not quote all his definitions and arguments here. He shows, by drawings from the skeleton and other means, that whenever the thigh appears lengthened, from depression of that side of the pelvis, the femur must be abducted; whenever it is shortened by elevation of that side of the pelvis, it must be adducted. In this sense the two words only relate to the pelvis itself, not to the axis of the body. I will explain this in my own language more tersely. Let us suppose the transverse axis of the pelvis an imaginary line drawn between the two acetabula, the thigh is neither abducted nor adducted as long as its axis is at right angles with this line. Suppose the

The whole side of the pelvis is also thrown forwards. This aids in increasing the apparent lengthening of the thigh, and it diminishes the projection backward of the tuberosity of the ischium, thus procuring a flattening of the nates, even though there be no wasting of the gluteus. These twists of the pelvis cause the *rima natium* to incline from below upwards and towards the diseased side. The spine itself will be thrown into corresponding curvatures all the way up, and thus a look of general distortion be produced. These signs are all merely the result of posture, and may be imitated by any one who has an accurate knowledge of the appearance to be assumed. The only unproducible point is the obliteration of the fossa behind the great trochanter; this in disease is much filled up by swelling. But in examining a diseased hip it does not suffice merely to place a patient upright before us; the examination must also be made under different conditions.

In the first part of the second stage the position is not so determined, nor is the limb so fixed that it cannot be moved slightly and examined in the recumbent posture. Let the patient first be on the back, upon a hard surface, such as the paillasse of a bed, or a table. The pelvis must, if possible, be placed at right angles with the spine, and the thighs at right angles with the transverse pelvic axis. In all probability these attempts at adjustment will be unsuccessful, but at all events there may remain so little twist that it would require a very accurate and practised eye to detect it. The inner condyle of the femur of the diseased side will seem lower than that of the sound one, so will the tuberosity of the tibia, internal malleolus, or other anatomical points. Now, if we measure the limbs we shall find little if any difference in their lengths. What difference we do find is, surprising as it may seem, contrary to ocular appearances. Thus, the limb which appears longer will (particularly if the measurements be taken rather on the outer side) measure shorter than the other.[1] Various instruments and methods,

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pelvis tilts so that the axes of the thighs remain the same, but that of the pelvis become oblique, this latter will be at an obtuse angle with the axis of one, at an acute angle with that of the other, limb; the former is ab- the latter ad-ducted. If the axes of the thighs be of the same length, it will be at once seen that while the pelvis thus tilts, one will be drawn up, shortened; the other depressed, lengthened. Shortening corresponds then with adduction; lengthening with abduction.

[1] This curious fact was first explained by Gädechens ("Hamburger Zeitschrift," 1836), who showed that when the ilium inclines to one side, its crista must ap-

of different degrees of complication, have been invented, in order to get accurate measurements of the thigh in hip-disease. They are all futile, as they have been invented to find out differences which are only apparent.

Another point in this position should be attended to. It has been said that in the second stage of morbus coxarius the thigh was flexed on the abdomen, yet the patient may lie with shoulders, buttocks, and heels upon a plane surface. If under such conditions, however, the position of the pelvis be examined, it will be found to be abnormally perpendicular; in consequence of which the lumbar and the lower dorsal spines are arched very considerably, and the hand placed below the loins will find a large gap between them and the mattress or table. This, it need scarcely be said, is not the method in which a healthy person lies. In fact, instead of the thigh being flexed upon the pelvis, the pelvis is flexed upon the thigh, and the relative position is the same.

Next, let the patient turn upon the stomach, and let the state of the nates, the inclination of the spine, and the relative apparent length of the thighs be examined, and it will be observed that distortion is not so great in this as in the erect posture, but it still exists. In this position the surgeon will most comfortably and readily examine the depression at the back of the trochanter, find any swelling or fluctuation, and the exact seat of tenderness.

Such is the condition of the patient, as far as mere deformity goes, in the early part of this stage. The pains of which he complains are several. One, a bursting, aching, gnawing, or burning pain, situated behind the trochanter, and in the groin, generally both, and this is combined with some deep-seated, perhaps fluctuating swelling. There is another pain, of a less defined nature, the well-known "pain at the knee," which is usually referred to the inner condyle of the femur; but if the patient be told to put the finger on the exact spot, he will be rather uncertain as to the locality. It is sometimes remittent, sometimes constant; it may be absent for hours, and then return with a sudden stab, which makes the patient start, and sometimes scream. It occasionally commences before this second stage comes on; but even then it gets worse at this time,

proach the trochanter of the femur: thus, though the whole thigh may sink and appear longer, the measurement between any point of the crista ilii and of the thigh must be shorter than the other limb.

so that it is more especially a symptom of this and the subsequent period of the disease. When it occurs early in the case, for instance, before lengthening has commenced, it occasionally leads diagnosis somewhat astray. I saw but a short time ago a case of hip-joint disease, in which blisters and other treatment had been applied to the knee. It is necessary, therefore, to guard against a too confident diagnosis without sufficient examination, more particularly as the chief seat of pain in knee-joint disease corresponds pretty closely with the spot usually painful in morbus coxarius.

The pain has been said to be of a remittent character. This is generally, but not always the case; sometimes the remissions are quite free, sometimes not so. When the intervals are not free, it is observed that the periodic pain gradually assumes a different character, until, in the latter part of this stage, it quite overrides and conceals the ordinary aching in the knee, and yet, while still not very severe, mingles with, and for the moment takes the place of the other. The intensity of these latter nightly pains is very variable in the period of lengthening, but is never so severe as during the next stage—that of shortening. Moreover, when their severity during the second phase greatly increases, we may confidently expect that the third period is about to commence. The pains owe their origin to different causes, although, of course, all derivable from morbid irritation.[1]

1st. Direct irritation of the nerves passing in close contiguity to the joint. These are the obturator nerves, the sciatic, the gluteal, and perhaps the anterior crural.

2d. An obscure sympathy between the two ends of the bone, or even direct propagation of the inflammation from one to the other.

3d. Spasm of certain muscles.

The first cause is that which Sir C. Bell and Sir B. Brodie advocate; and when the close proximity of the obturator nerve and of the anterior crural nerve to the joint be considered, it will not be surprising that they should be influenced by the pressure or organic irritation of the disease. Brodie relates a case in his chapter on "Neuralgia of the Joints,"[1] which shows that such referred sensation is physiological.—"A man was admitted into St. George's Hospital, under the care of Sir Everard Home, complaining of pain in the knee, and of nothing else. On inquiry into his case, however, it was also found that he labored under femoral aneurism. Sir E. Home applied a ligature above the tumor, which immediately diminished in size, the pain in the knee subsiding at the same time. The patient died afterwards of venous inflammation, consequent upon the operation; and on examining the limb I found that some branches of the crural nerve lay on the surface of the tumor, which terminated in the exact spot to which the pain had been referred and thus at once explained the origin of the pain, and the subsiding of it on the tumor becoming reduced in size after ligature of the artery."

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[1] It would lead us very far indeed to give all the different solutions, right or wrong, which have been attempted, yet it is only proper that some should be quoted. Sir C. Bell attributed this pain to irritation of the obturator nerve. Sir B. Brodie appears to entertain a similar opinion. Op. cit., p. 123. Coulson, to continuity of the inflammation along the aponeurosis of the rectus muscle, one of whose heads arises from the border of the acetabulum, and is closely connected with the cotyloid ligament (this hypothesis is, however, too far-fetched, and is founded upon no fact). Richet conceived it to be due to propagation of the inflammation along the medullary canal to the lower end of the bone. Bonnet attributed it in many instances to malposition, which caused a constant strain on the ligaments and muscles of the knee. Stromeyer to spasm of the psoas and iliacus internus. Walther and Fricke to sympathy between the two ends of the bone.

This case shows that pressure upon the anterior crural nerve will produce this peculiar pain in the knee. The obturator nerve lies in as close a relation both to the hip and the knee-joint, and would doubtless be influenced in a similar manner by morbid pressure.

The second cause is obscure sympathy, or propagation of the inflammation by contiguity of surface. There is no more tempting method of cutting a difficulty than to refer it to sympathy, but this particular instance is supported by one fact, given by Wedemeyer.[2]

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[1] Op. cit., 5th edition, p. 281.

[2] Wedemeyer, in speaking of necrosis, says, "All these sympathetic pains have this peculiarity, that they never pass along the nerves upwards, that is towards their origin, and that they are never increased by outward pressure, and this latter circumstance should always produce a suspicion of a distant origin of the malady. Lastly, I must remark that these pains usually follow the course of the nerve lying close to the disease; but that there are cases in which they are transmitted along the medulla, or along the periosteum of the bone to its end. Thus, I have now under my care an unfortunate boy suffering from caries and suppuration of the hip-joint, in consequence of which the caput femoris is dislocated upon the ilium: has penetrated, by ulceration, through the soft parts and lies bare, merely covered by delicate granulations. When I press with my finger upon this denuded head of the bone the patient does not complain of pain at that spot, but, by an involuntary movement, grasps the condyles of the femur, and complains of very intense

In attributing the pain of the knee to propagation of the inflammation along a continuity of surface in the medullary canal, M. Richet only follows out his method of accounting for many wandering, uncertain sensations, which, he says, accompany joint disease. But this would not be an adequate cause for the violent pains, though it may be so for the constant dull aching.

The third cause, viz., spasm of certain muscles, I hold to be of very great importance. It is connected with both the dull aching and with the sharp intermittent pains. These latter are chiefly prevalent at night, when the patient is sinking to sleep. They are sudden, both in their appearance and disappearance; come with a great jump or start of the limb, which wakes the patient with a cry or moan of distress. In the first part of the night, before the patient is very heavy with sleep, these attacks wake him altogether, with the expression of dread and pain peculiar to his age; later, when slumber is pretty sound, the pains only startle him for an instant, perhaps produce a sharp cry, but he sinks to sleep again immediately.[1] This is the same symptom that we observe in diseases of other joints, and which we have attributed (Chaps. V. and XI.) to inflammation of the bone close to the articular lamella; it is by no means so severe as in subsequent stages, but throughout hip-joint disease is more violent, in proportion to the organic changes, than in affections of other joints.[2] Exactly corresponding to the severity of this pain, is the amount of wasting which the limb undergoes. Such wasting is not mere loss of nutrition from want of exercise, for it is not only much more rapid, but is of a sort different from the emaciation so caused; the muscles, instead of becoming soft and flabby, are tense like cords, and remain so, even while they grow thinner. In fact, we find, on examining the limb, during the whole time in which these sharp pains prevail, that there is a constant tonic contraction of the muscles, which is proportionate to the continuous wearing pain usually referred to the knee, and at the same time produces the sort of wasting peculiar to that form of

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pain in them, although pressure upon these condyles themselves is entirely painless."—Wedemeyer, "Bemerkungen über Caries und Necrose," Gräfe und Walther's Journal der Chirurgie, 5ter band, 3te heft, S. 626.

[1] Dr. Bauer, of Brooklyn, has given a very graphic account of this form of pain. "On Hip and Knee Joint Disease," p. 8.

[2] There is much variety in the severity of these pains during the second period of hip-joint disease, which depends, I believe, entirely upon whether or no the bones have or have not been primarily affected.

contraction.[1] The reader will pardon the apparent circuity of my course in again referring to lengthening of the thigh. We have seen that certain of the femoral muscles contract abnormally, and very little experience in hip disease shows that those first affected are the tensor vaginæ femoris, the gluteus medius, and probably also the deeper abductors of the thigh. By such abnormal action the limb is carried outwards; the patient while erect cannot keep the thigh suspended free in the air, and hanging by its whole weight on the body; he must place the foot on the ground, and, to do this, is obliged to let that side of the pelvis droop: thus producing the apparent lengthening. This is the real cause of that symptom. The whole of it is an effect of abduction from contraction of the above-named muscles.[2]

This stage of lengthening lasts an indefinite time, it may then slowly become less marked—the spasm less, and, with it, the deformity—and the patient may recover without going through further stages of the disease; or, on the other hand, he will get worse. The malady advances, not by regular increase, but by uneven exacerbations and ameliorations, yet, as it grows, each period of ease becomes shorter, each one of trouble longer and more severe. The patient wastes quicker, eats less, sleeps less, and suffers more. I have not unfrequently gone quickly to a patient's bed and seen him in a disturbed sleep, when the weather has not been hot nor the bedclothes by any means excessive, yet the uncovered face, chest, hands, and sometimes the arms, were thickly studded with beads of sweat. Here it must be remarked that patients in this part of the disease never lie on the affected side.[3] The position is variable—if he have access to pillows and cushions, he will be likely to lie on the back, supporting the knee with a pillow. (I am assuming that the patient be left to his own choice.) If he have no such means of supporting the thigh, and in the latter end of this stage even if he have them, his position of choice will be that of lying on the sound side a little over to his front, the affected limb crossing the other, the inside of the knee resting upon the bed; when we find that the patient assumes this posture, we may be sure that the second stage has ceased and the third begun.

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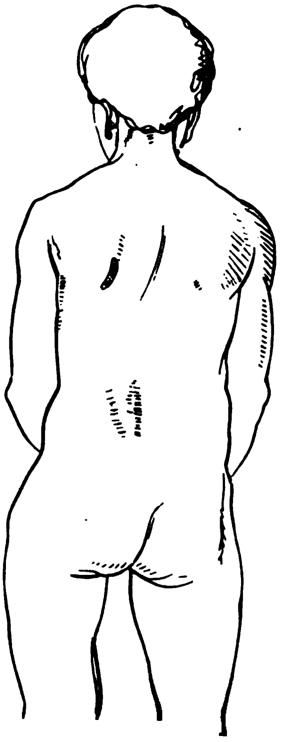
[1] As it will be necessary to refer at greater length to these nervo-muscular symptoms, we in this place only dwell upon them long enough to point out their effects and actions.

[2] I need only ask any surgeon to examine a number of hip cases in this stage in the erect and in the recumbent postures, and, while doing so, to place his fingers over the *tensor vaginæ femoris* and *gluteus medius.* Then I will ask him to get some person undoubtedly sound in the hips to stand before him erect, with heels together; let one leg be abducted and carried slightly in front, then placed with the sole on the ground, no bodily weight being thrown upon that limb, and the surgeon will see at once that this abduction, and necessity of resting the limb, give rise to the entire appearance of lengthening, the pelvis inclining over in order to let the foot come to the ground.

[3] Some authors have affirmed that patients occasionally lie on the diseased side. Such statement cannot originate from personal observation, unless the stage of the disease has been mistaken.

Third Stage.—There is, between the periods of lengthening and shortening, some neutral tract of time, during which the painful symptoms very much abate or altogether cease. But this is only a treacherous calm; there suddenly occurs a more violent shock of pain, and the spasms from that time become more intense than during the second stage. If now we subject our patient to a careful examination, we shall find the malformity in nearly every point the direct contrary to that already described. While in the erect posture, he supports the weight of the body on the sound limb, the diseased one rests on the ground only by the ball of the foot, the heel being elevated, and the knee is higher than that of the sound side; the thigh is slightly (in advanced cases considerably) flexed on the pelvis. The buttock of the diseased side is shorter and more protuberant than the other; it is commonly said to be more rounded; its form is, to my mind, better explained by saying that it projects backwards almost to a point. The diseased side of the pelvis is raised, and the *rima natium* slopes from below upward and away from that side. The lumbar spine is curved laterally, its concavity looking towards the disease; the dorsal region is bent in a contrary sense, its convexity being towards the affected side, and the shoulder

Fig. 21.



Hip [illegible] hort-
ening

of that side slopes more down, is more depressed than the other. The foot of the diseased limb may be either inverted or everted; the former is the more common, but cases occur in which the contrary posture obtains.

At the same time the tenderness behind the trochanter and in the groin diminishes. The deep fluctuating swelling is exchanged for a more diffuse non-fluctuating tumefaction, which is superficial, and accompanied by a certain puffiness of subcutaneous tissues. Soon afterwards abscesses form and burst in places, which vary in different cases according to certain circumstances to be hereafter considered.

The whole series of symptoms indicate the following pathological changes. During the latter end of the second stage the capsule of the joint has been distended by fluid, generally by pus, and the alleviation of the pain forming an interregnum between the two periods corresponds to the rupture of the sac and cessation of distension, after which a more diffuse action is set up in the parts around.

It is not possible to say why, during distension, contraction of the abductors should predominate; why, therefore, as long as such condition lasts, the limb should be lengthened; nor why a change in these circumstances should afterwards supervene. At p. 309 was described a position which, at the end of the second stage, the patient assumes, in order, as is evident, to yield more and more to the contraction of the adductor mass, whose power at that time begins to prevail.. A glance at the position of shortening will show that the axis of the affected thigh is at an acute angle with the transverse axis of the pelvis,[1] the thigh therefore adducted. This adduction is the primary malposture in "shortening;" for such condition, unless balanced by a compensating position, would cause one thigh to cross the other—a posture which cannot be maintained while standing, and only to a limited degree while reclining. In order therefore to preserve a parallelism between the two limbs, the patient must abduct the sound one to the same extent as the other is adducted. This can only be done by producing an obliquity of the pelvis; by raising the diseased and depressing the sound side, thus causing the affected thigh to look shortened, while measurement carefully carried out shows no real shortening whatever.[1]

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[1] For explanation of ab- and adduction as measured by the angles of the axes, see note at p. 303.

These nervo-muscular phenomena in hip-disease are so prominent and remarkable, that their evident results as seen in the posture and apparent length of the limb have chiefly attracted the attention of surgeons, and yet the peculiar influence which they have upon the continuance of the malady has escaped notice. Be it observed that the constant and violent contraction does not merely produce ab- or adduction, according as one or the other set of actions may prevail; but, as from the direction of the muscles is evident, it must also draw the thigh upward and cause the head of the femur to press abnormally against the acetabulum. Thus the pristine inflammation having produced a contraction, the head of the thigh-bone begins to press with abnormal force and constancy in the upward direction. We might subdue the inflammation but that the very pressure keeps up the contraction whereby it was primarily caused.[2] To prove this position we have only to look at pathological museums: we shall find a few specimens in which the action is distributed over the whole joint-surface; a very few indeed in which the inflammation has chiefly attacked the lower posterior or anterior part of the acetabulum and femur; but in a proportion of cases so large as to render the above examples mere exceptions, the upper lip of the cotyloid cavity and the corresponding part of the caput femoris are ulcerating, while all the rest of the bone may be untouched. Such constancy of action can only be accounted for by the fact that abnormal muscular contraction produces pressure, and thereby ulcerative absorption of these parts. The annexed figure, from Mr. Howship's collection in the Charing-Cross Hospital Museum, is not taken from a specimen particularly chosen to prove these circumstances; in fact, it presents an unusual amount of action at the lower part of the acetabulum, evidently produced by the gravitation of pus. Let it be observed how the cavity of the acetabulum has been prolonged about an inch upwards; how the head of the femur has been altered in form; how, also, in the position which in life they last assumed, the two fit accurately together, and how the track left behind became narrower as the caput femoris wasted. It is plain from this mere physical evidence that the head of the femur was used almost like a copperplater's graver, to furrow

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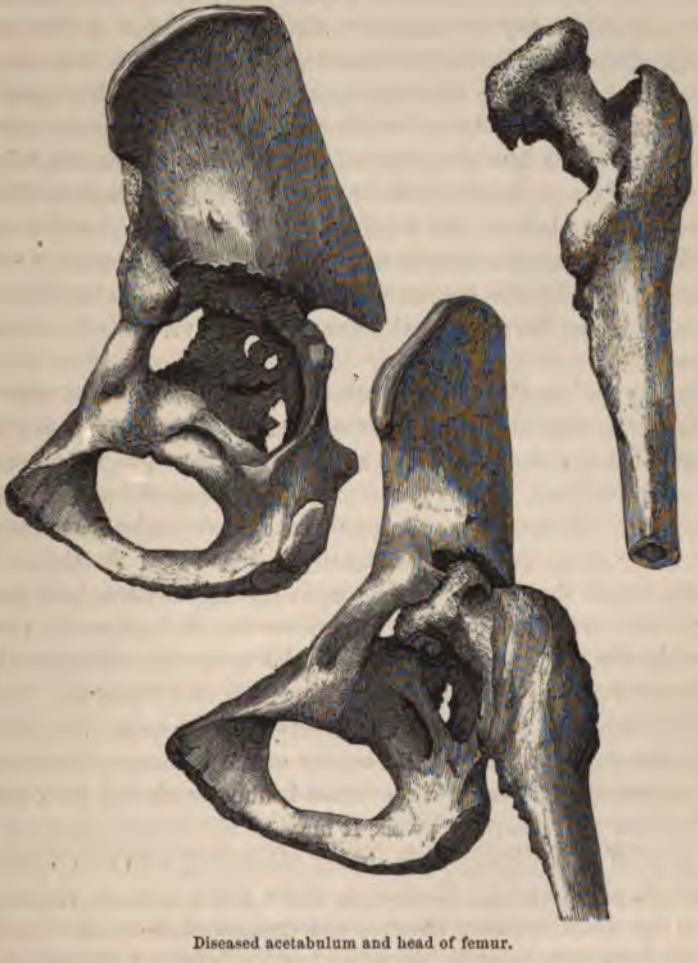
[1] That posture produces shortening in the majority of cases was also the opinion of Bonnet.

[2] This sort of reactive tendency is the constant law of muscular irritation: if a sharp-cornered atom be thrown into the eye the lids close upon it, and, if the part be irritable, the more it cuts the conjunctiva (that is the more it is pressed upon) the more violently does the muscle contract. A man's thigh is broken by some violence that causes the fragments to pierce, or otherwise injure, some of the muscles; contraction instantly commences; the more the organs be damaged the more spasmodically do they act, and the more they contract the more will they be hurt.

Fig. 22.



Diseased acetabulum and head of femur.

the cotyloid cavity upwards on the ilium, and has been almost worn out in the process. It has been held tightly to the floor of the cavity by the pyriform, obturator, and other capsular muscles, while it was forced upwards by those previously specified as abnormally contracted. Thus the acetabulum is made to travel upwards and also inwards, whereby an opening through the floor of the cavity into the pelvis is not unfrequently produced, as shown by the figure. I say, that such evident yielding to the pressure upwards is not an exceptional case, but is the rule: that when we find a hip-joint ulcerating in any other way and position, it is that some rare circumstance has caused a primary osteitis in that particular spot. It must also be remarked that as the head of the femur travels upward, producing, in that part against which it presses so abnormally, ulcerative absorption, it causes beyond that point an additional growth of bone, forming a new lip to the new cavity[1] (according to the law of increased growth and induration beyond the focus of a suppurative inflammation). It follows, naturally, that the change in place of the joint-cavity as in the head and neck of the femur produces a certain amount of *real* shortening, but this is slight—probably does not exceed an inch—yet adds to the difficulty in appreciating the occasional later and more violent effects of the disease.

During this osteitis and the mutual compression of the articular surfaces, we find the symptoms of that condition developed in a remarkable degree. We have already seen that when the bone in the neighborhood of any joint becomes inflamed, starting pains supervene. This symptom is very strongly developed at the hip, producing great dread, suffering, restlessness, and wasting. The shocks attack the patient just as he is sinking to sleep, and are in proportion to the tonic spasm. It seems that as long as the person is awake the controlling influence of the brain is sufficient to prevent any irregular nervous phenomena; but that when this is withdrawn the excito-motory system exerts all its power. So constant are these symptoms to the particular morbid change, that when a patient presents himself, whose limb is shortened, and who suffers much from these starting pains, it may be confidently asserted that the head of the thigh-bone is slowly ploughing a groove from the acetabulum upwards. Moreover, these pains are so violent, so much dreaded, that they deprive the patient of sleep and appetite, plunge him into perspirations, render his whole nervous system extremely irritable, and add greatly to the rapidity and destructiveness of the disease.

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[1] The production of new bone is most marked in rheumatic osteitis (in which malady, also, the acetabulum travels upwards); in the most cachectic cases of strumous hip-disease very little or no new rim is produced.

The muscles which are affected with contraction gradually shorten organically and permanently; they become passively *contractured;* that is to say, their decrease in length is not merely a passing state, which, when the stimulus ceases, will disappear. They become fixed in this shortened condition, either by the gluing together of their elements, or some like cause, and they cannot of themselves resume a relaxed and lengthened position.[1] Thus, the deformity becomes more and more permanent and organic, while the active condition still going on increases not only the deformity, but the morbid pressure.

It was observed (p. 311), that at the end of the second stage the capsule of the joint is distended by fluid, generally by pus; that there follows rupture of the sac, after which a more diffuse action is set up, which is followed by the formation of abscesses. These present themselves in various localities, according to certain circumstances, and chiefly according to the spot at which rupture of the capsule may have taken place, and the position in which the patient has been kept. It is most usual that the first appearance should be somewhere in the neighborhood of the great trochanter, most frequently behind it. This pus comes from an opening at the back and upper part of the joint; an abscess at the outside of the thigh from the posterior and inferior aspect, the pus travelling beneath the fascia lata. Abscess at the lower part of the groin, or inside of the thigh, shows that the capsule is torn in front.[2] The appearance of an abscess high in the groin, *i. e.*, immediately below Poupart's ligament, is of great importance in diagnosis, for in such case we may conclude that the acetabulum has opened into the pelvis, or that the floor of that cavity is perforated. There are two modes in which an abscess, in this situation, may communicate with the hip-joint, either directly running backwards through the capsular ligament (a rare condition), or by entering the pelvis and passing through the floor of the acetabulum; indeed, a pelvic abscess, connected with hip-joint disease, may occur before the bone has been actually perforated, when the whole thickness of the floor of the acetabulum is involved. Some remarks on this subject by Mr. Hancock are so pertinent that I cannot forbear quoting them.

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[1] It appears to me, from the very slight opportunity for examination of such condition which has presented itself, that this change is located in the sheath of the fibres rather than in the fibres themselves. Every fibre of a muscle is composed of a sarcos and of an investing wall; the active contraction of a muscle is produced by shortening of the flesh; passive contracture appears to supervene after the interior has been for some long time in this shortened condition, when the investing part adapts itself permanently to that shape, and each wall of every muscle-cell is fixed in its abbreviated form. Moreover each portion of areolar tissue investing the fibrous bundles assumes permanently the new form impressed upon it by the inclosed and contracted cereos. Such change does not forbid continuation of active contraction, for the state (contracture) depends upon change in the passive parts of the organ, to which ordinary muscular contraction may be added.

[2] The length of these burrowing abscesses—in fact, the choice of a downward direction for burrowing at all—depends upon gravitation; hence those who have been kept on the legs while hip-disease goes on will have abscesses down the thigh almost to the knee; those who have been kept in a recumbent position have them opening about the hip, buttock, or groin.

> "We must assure ourselves that the pelvic abscess has been preceded by hip-disease; is connected with it, and not with disease of the spine, with psoas, or iliac abscess. One point, therefore, in this diagnosis is the pre-existence of hip-disease. Another is the locality at which the spontaneous openings usually occur. When the matter is poured into the pelvis through the perforation of the acetabulum, it falls as we have seen between the obturator fascia and the bone, and in consequence of the firm attachment of the former to the falciform margin of the great sacro-sciatic ligament, the matter cannot reach the skin in that direction; but by gravitating posteriorly by the rectum it presents itself by the side of the anus, simulating fistula. It occasionally bursts into the rectum itself, or the vagina; and it has been known, by its pressure upon the neck of the bladder, to interfere greatly with the process of micturition; but the more frequent position, as far as my experience serves me, is at the outer part of the groin, near the anterior-inferior spinous process of the ilium, probably induced by the position maintained by the patient at this stage of the disease. This is a point to which I am induced to attach some importance, as affording a means of diagnosis between pelvic and psoas abscess, as the latter usually presents more internally nearer the middle of the groin. The existence of openings externally in the neighborhood of the joint will also assist; as pelvic abscess connected with hip-disease very rarely, if ever, takes place without having been preceded by suppuration about the joint itself.
>
> "When the opening occurs in the groin, the existence or non-existence of perforation of the acetabulum may be ascertained by a probe, slightly curved; by introducing it into the opening, and directing its point downwards and outwards it may be passed through the perforation into the joint; and I have also observed, that whereas in psoas abscess the probe can be more readily passed backwards and upwards, in these cases it takes the opposite direction—backwards and downwards. In some cases of hip-disease an abscess forms in the pelvis before actual perforation of the acetabulum occurs."[1]

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[1] Mr. Hancock, "On Excision of the Head of the Femur," Lancet, April 25th, 1857, p. 421.

Dislocation of the head of the bone from disease, or spontaneous dislocation, as it is called, is an occurrence so unusual that one is astonished at the general credence in its frequency. It is only about ten or fifteen years ago that every hip-joint disease was supposed to end in this way; but if a search be made in the College of Surgeons, St. Thomas's, St. Bartholomew's, or other of our great pathological museums, there will be found but very few specimens exhibiting simultaneously the signs of morbus coxarius and of dislocation. On the other hand, it is by no means uncommon to find the head and neck of the femur shrivelled to little more than a button-like projection, the acetabulum quite altered in form and place, and yet the bone retained in its cavity.[1]

Sir B. Brodie[2] evidently attributes all shortening of the limb to dislocation; he calls it real, in contradistinction to lengthening, which he very rightly considers apparent. Unfortunately, this distinguished surgeon quite overlooked the influence of position as a cause of shortening, and has thereby added his great weight to that fallacy, which produces a mode and habit of looking upon hip-disease which is not likely to aid in establishing a rational and successful treatment.

Liston, however, in his lectures (*Lancet*, 677, p. 40), says that shortening does not often take place from dislocation. Dr. Bauer (op. cit., p. 12) also insists upon its rarity. For myself, I am persuaded that spontaneous dislocation of the hip-joint is uncommon in comparison to the frequency of its absence. It occurs only in cases of so cachectic a character, that new bone is not produced beyond the focus of suppuration, as was pointed out at p. 304 to be usually the case.[3]

The diagnosis in an old case of hip-disease, between a dislocated and a non-dislocated bone, is not so difficult as it is supposed to be if the surgeon will bear in mind this singular and important fact. When the head of the bone becomes spontaneously dislocated upon the ilium the malposture of the pelvis gradually decreases, so that the thigh is in such a case not shorter than the limb affected with ordinary hip-disease, but still with its head in the cavity. It must be remembered that in a full grown person, the thigh may be apparently shortened through mere position by three inches—that is to say, the knee is that distance above the other; if, in such a case, a dislocation upon the dorsum ilii were to shorten the limb two more, the knee of the affected side would be very little beyond half way down the thigh of the sound one. As before stated, however, in those rare cases in which dislocation takes place, the side of the pelvis slowly comes down, since mutual pressure of the joint surfaces ceases, and even the passive contracture of the muscles yields to a considerable extent. Such has been the condition in the two instances of old spontaneous dislocation which I have seen during a pretty extensive search of more than ten years. Hence, if a surgeon find the pelvis in the ordinary oblique posture of hip-disease, and only an ordinary amount of shortening, he may conclude with considerable confidence, that he has not to do with a case in which dislocation had occurred. In the example from which the annexed plate was taken, there was no dislocation, and it is given in order to show the amount of distortion which may prevail without such concomitant. Anatomical examination and manipulation of the limb must be used to aid the diagnosis; but to discriminate the actual position of distorted parts, among a mass of swollen and diseased textures, is extremely difficult. Nelaton's test is ingenious and simple: a piece of string is carried from the anterior-superior spinous process of the ilium to the tuberosity of the ischium; if the bone be normally placed, this line falls on the upper part of the trochanter major; but if the head of the femur be upon the ilium, that process will lie far above the string. It is to be remembered, in using this test, and in manipulating these parts, that the position of the trochanter is often greatly changed, in the absence of luxation. The head, as also the neck, of the thigh-bone (a part which in all its injuries and diseases suffers from defective nutrition), yields rapidly to carious disease, so that not unfrequently all that is left of these parts is a little button projecting into the acetabulum, from between the trochanters. Again, as we have seen, the cotyloid cavity itself becomes altered, its projecting rims more or less eaten away, and the place where the button-like remains of the head are in contact with the pelvis, very much changed.

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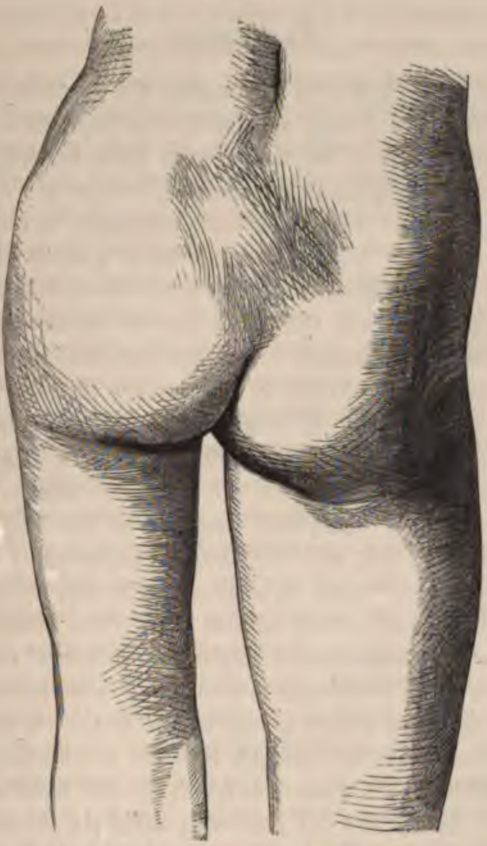
[1] The condition figured and described at p. 313 is not a dislocation, for the head of the bone still remains in the acetabulum, though both may be altered in shape and even in position. Luxation is only to be affirmed when the cavity, however altered, no longer contains the caput femoris.

[2] Op. cit., 5th ed., pp. 117, 118; the passage is too long to quote.

[3] The remarks upon spontaneous dislocation refer only to displacement upon the dorsum ilii. There are one or two instances on record in which the thigh has been luxated on the pubes into the foramen ovale and into the sciatic notch, but these are so rare that it is hardly necessary to notice them. In those cases of spontaneous dislocation upon the ilium which I have seen, the posture of the patient and the form was so different to that of ordinary shortening, that if it were once pointed out upon the living subject it could not be again mistaken.

Fig. 23.



Old hip-disease—shortening without dislocation.

True anchylosis is a rare sequela of disease in the hip-joint: it is chiefly mentioned here, in order to point out the extreme difficulty of diagnosing the presence or absence of this condition, if the patient be a child under twelve or fourteen, and the disease have lasted a considerable time. A certain amount of movement in the thigh can be produced, but a closer inspection will show that in all cases of advanced hip-disease the axis of motion is not the joint itself, but the sacro-iliac synchondrosis, which becomes excessively flexible.

A patient was in the Charing-Cross Hospital, at the end of the last and beginning of the present year, in whom this mobility was remarkably developed. It was impossible to come to any conclusive judgment until chloroform was administered.

TREATMENT.

First Stage.—The first sign of limping, the first complaint of pain in the hip, should, in young and strumous persons, attract instant attention; and unless it be the merest passing evil, the sufferer should be subject to skilled examination, so that any disease which may be found to exist may be at once subjected to treatment.[1] In the commencement of hip-disease, we have simply to do with an inflammation not combined with any muscular spasm or other complication, and our efforts therefore are to be directed simply to combating this morbid action. The first indication is to render the joint motionless, and to do this it is necessary that the pelvis, thigh, and lower leg be fixed. A large number of apparatus has been devised for this purpose. The double inclined plane, Earle's bed, Heine's complicated couch, have all the disadvantage of confining the diseased hip too little, and the rest of the body too much. Bonnet's *grand appareil,* and Dr. Bauer's imitation of it, which he calls "wire-breeches,"[2] have this great fault, that in rendering the diseased hip immovable, they at the same time absolutely fix the other limb and in a considerable degree the vertebral column. The irksomeness of such treatment is something inconceivable; indeed, Bonnet acknowledges that it is impossible to keep a patient longer than from three weeks to a month in such constraint, and recommends that after such a time, the splint should only be applied at night; indeed, he relates the case of a child six years of age, who was kept in his apparatus two months, at the end of which time he had very nearly lost the use of his limbs altogether.[3]

To obviate such inconveniences, and at the same time to obtain certain other advantages to be presently explained, I have taken much pains in the construction of splints, which, while carrying out a rigid principle of treatment, shall permit such modifications as may be necessary or more advisable for particular cases. In this, the first and early stage of the disease, while there is as yet no spasm, no morbid contraction of muscles, nor any alteration therefore in the position of the limb, I use a splint of the following construction: One portion made of wire-gauze, with a border of thicker wire, passes round the pelvis from one spine of the ilium to the other, its upper edge corresponding accurately with the crista ilii, and the whole being of such breadth, that the lower border lies immediately above the trochanter. Another portion on the diseased side runs from the end of this pelvic band down the outer aspect of the thigh beyond the knee; the two parts being immovably joined together, or cut out of the gauze in one piece. In order to secure a more lasting fit of the pelvic portion without making it too stiff, a little hook is placed at each of its ends, to which an India-rubber belt, passing across the abdomen, can be attached at a proper degree of tension. (See Fig. 24). The angle between the pelvic and thigh portions must be such as will cause the femur to be extended on the pelvis (this will be an obtuse angle), as a flexed position gives rise in subsequent stages to certain embarrassments, which should be avoided. If the surgeon intend to apply any counter-irritants behind the trochanter, a portion may be cut away from the back of the thigh-piece, and lest this should weaken the apparatus too much, the back of the pelvic band may be connected with a lower point of the femoral portion by a piece of strong wire, or better by a piece of flat steel, so curved as to avoid the trochanter, and to fit the buttock. I have used all these forms with advantage; they keep the hip quite immovable without irksome confinement of other limbs, and if well fitted, padded, and

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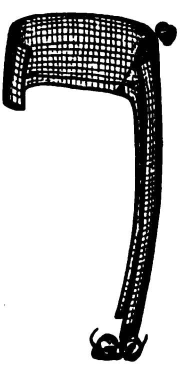
[1] Constitutional treatment is not considered in the present chapter, as it was fully handled in Chapter V. on Strumous Synovitis.

[2] These machines consist of iron bars connected by wire gauze, which inclose the pelvis, both thighs, legs, and feet; fixing immovably the whole lower half of the body.

[3] Op. cit., vol. ii. p. 327.

Fig. 24.



Splint for hip-disease in children.[1]

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[1] The use of pulleys at either end of the thigh-piece will be explained hereafter. For full-grown persons I find it preferable to make the thigh-piece of wood, which must be fixed by screws or other means immovably to the pelvic portion. See Fig. at p. 326. The thigh-piece is represented as broken, and a part removed to avoid giving the figure too much length. The extending apparatus and perineal band are only to be used in a later stage.

fastened by means of a pelvis bandage, are a very comfortable form of splint. The gauze, with its edge of a thicker wire, can be bent to the requisite form, and by help of the India-rubber band across the abdomen, retains a very perfect fit. In the more acute cases, it may be desirable, that means should be used for allowing the adult patient to be raised, without producing movement of the hip, so that a bed-pan may be placed beneath him. This is easily arranged, by means of a pulley fixed to the ceiling, or the upper part of the bedstead immediately above the middle of his body; through the pulley passes a rope, one end of which is attached to four cords fastened respectively to each end of the pelvic part of the splint, and to each leg by a broad band. The other end of the rope hangs within reach of the patient's hands. By pulling upon this part of the cordage the patient can lift his whole body, and the apparatus, from the bed.[1] A child too young to execute this manœuvre can be lifted so easily that no such apparatus is necessary.

Upon the value or uselessness of counter-irritants some difference of opinion prevails. This appears to me to have arisen from want of clear discrimination between the different stages of the disease, and of the various pathological conditions present at different times. My experience during many years of observation and practice convinces me, that in this, the earlier stages, much benefit is to be derived from a judicious use of counter-irritants. It is unnecessary to re-enter into a description of reasons why, in certain conditions, one method should be preferred to another. They have been amply discussed in previous chapters; but it is advisable to point out that such means must be utterly unavailing, although sometimes so employed, when the patient is allowed to remain without any means of confining the joint. It is such treatment, such utter blind reliance upon these means *alone*, which has brought them into discredit.

Much experience, and a long careful process in summing up the results of practice, are necessary to decide which combination of applications best suits a number of different circumstances; but I nevertheless believe myself in a position to say, that the symptoms which have been described as indicating synovitis of the hip, more especially of a subacute character, are best met by the more superficial counter-irritation, a blister kept open by the application for two or three days of the savine cerate, but never so long as to produce constitutional irritation; or the blister may be allowed to heal and then the skin kept inflamed by tincture of iodine. There are many other such means; but it is unnecessary to enumerate a series of remedies with which every surgeon is acquainted. When, on the other hand, the symptoms are such as indicate osteitis, a more potent application is preferable. An issue of potassa fusa is a very frequent application. Opinions concerning the value of the issue and moxa class have already been given; they are somewhat cruel remedies; but if the sore be kept active or irritable, and be not allowed to fall into an indolent condition, it will doubtless have effect. The actual cautery is by far the most efficient of these means; its efficacy cannot be too highly extolled in the first stage of hip-joint disease, commencing in the bone, and when the patient is not very feeble. It is not only more efficient, but also less painful in its operation than the potassa. It is necessary, however, to warn the unaccustomed hand against drawing the striæ too near together. In the commencement of my acquaintance with the cautery, a case occurred in which, being over anxious to give the remedy its full force, I drew the lines too close. The patient was of feeble constitution, and a good deal of the skin left between the burns ulcerated, produced a large sore, which was very obstinate, and added, I fear, to the patient's sufferings. The line, or lines, should be drawn from the trochanter, as radii from a centre. Of late I have made but one, or at the most two at least an inch apart, and believe that such an application is as useful, and less perilous, than one involving a greater amount of skin destruction.

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[1] This plan is borrowed from M. Bonnet.

Immobility of the joint is to be preserved as long as any signs of inflammation exist. It is not always easy to ascertain when it may be safe to allow movement of the limb. As long as there is tenderness behind the trochanter (all blisters or cautery sores being healed) the splint must be kept applied; even after tenderness has ceased, pain upon flexion, even upon considerable flexion, of the hip shows that the limb must still be fixed. It must be remembered, however, that when the splint is removed the joint is not immediately to be flexed and twisted, that we may judge of its painless or painful condition; such movement is sure to produce muscular pain when all joint-inflammation may have ceased. The limb, when released, must be rubbed and shampooed; and it is only after some hours that we can judge of the condition of the articulation. Even when the splint is discontinued, the patient should be kept in bed for a day or two before he is allowed to get up; all persons on first gaining liberty are very apt to abuse it.

The Second Stage.—It will happen, even when all possible skill shall have been employed, during the early condition of this disease, that the symptoms will increase; but it still more often occurs that the patient does not come under professional observation until the second stage has commenced. In this condition we do not find any symptomatic difference between the two forms of the malady; the synovitis having produced ulceration of cartilages involves the bone next the articular lamella; or the osteitis in which the disease may have commenced has attained that locality. In either case we have that peculiar train of symptoms which follow such affection. Among the most remarkable and most painful of these are the clonic spasms, which come on at night, causing sleeplessness or dread. It is of great importance to annul, or at least to mitigate, these spasms, not only on their own account, but also because they accompany lasting contraction of the muscles, and because their amount corresponds sufficiently closely with the rapidity of destructive process. Now, no opiate which our art supplies annuls these pains; it has been allowed me to watch patients, thus suffering, who have taken a heavy dose of laudanum, and in one or two instances it has seemed to me that they slept more through the pain; but, that it was still there, was evidenced by their starting up momentarily and falling back again to sleep, or by a sudden sharp cry or groan; in fact opium may dull the perception a little, but does not check the spasm, if indeed it does not increase it; for the limb, in the cases I speak of, has jerked with much force, and while this lasted the patients were bathed in sweat. The pathological condition of the nerves, already described, is not one which could be diminished by an opiate, or by any means tending to decrease the controlling action of the nervous centres. A contrary remedy, namely, some diffusible stimulant, as a little wine, ether, or ammonia, given at night, has, in my hands, been productive of greater benefit.

If the patient come to us for the first time, when the disease is well advanced into its second stage, when lengthening, with abduction and flexion, has lasted for a certain period, and there are nightly pains and spasms, we shall find that, by placing the limb in its proper position, viz., straight, neither abducted nor adducted, everted nor inverted, and confining it in that posture, we may greatly diminish the starting pain as well as the continuous aching. The reason that this change in position should effect so much benefit is not easily explained. M. Bonnet, who insisted strongly upon its value, assumed that it diminishes, or altogether prevents, tension of the capsule. This, I can hardly conceive possible, since, in order to put the limb in that posture, he often used very considerable violence, which must have produced tension of some part of that structure.

In this, the second stage of the malady, there is no difficulty in putting the limb into a proper posture: it may be done at once, early in the period, by judicious management, and by making the less violent deformities yield before the others. While the patient is lying on the back his thigh and leg will be flexed, the limb resting on the bed by the foot and buttock, with the knee abducted and everted, i. e., inclined to lie on its outside upon the bed. The surgeon places his hand on the outside of the knee, and by lifting it away from the bed he overcomes at once the two latter malpostures, giving, if the stage have recently come on, but very little pain; he waits a little time, in order that the patient may recover from the first shock of this change; he then, holding the knee in one hand, grasps the ankle with the other, and straightens the leg upon the thigh, thereby relaxing the extensors, and allowing him, with a little force, to place the thigh in extension, *i. e.*, flat upon the bed.

In most cases, however, indeed in all those which have continued some time in this stage before coming under treatment, this method would be not only too painful, but would be absolutely injurious. M. Bonnet[1] employed and recommended machines and manipulations of vast power for this purpose, which to me appear not only unnecessary, but dangerous, and conceived upon false principles. Moving a diseased hip backwards and forwards, producing such forcible flexion that the front of the thigh touches the abdomen, simply in order to relax contracted parts sufficiently to allow its being straightened, can hardly be wise. During the whole of this second stage, the deformity is due only to muscular contraction from nervous irritation, and a very slight force, if continuous, will overcome this power. The essential is to obtain a *continuous* force. All the various forms of screws, pinions, and racks are not continuous when applied to a living organism; the former are fixed, the other is moving: so that at one time the power will be intense and rigid, at another will not be exerted at all. A spring is the only force which, while it yields sufficiently to the movements and struggles against confinement, which a living part is sure to make, yet exercises a constant, never-failing traction, sure in the end to overcome muscular force, without painful rending and violent stretching of parts. Any deformity from muscular contraction[1] at the hip may be restored to the proper posture by means of the extending splint, with the pelvic wire-belt. I will not detain the reader by describing the mechanism of pulleys, straps, &c., as it has been already done (p. 268), but the method of using the splint for this particular purpose must be explained. Let us suppose the patient lying on his back, with the affected limb bent both at hip and knee. The surgeon begins by applying a broad piece of strapping on either side of the leg, from the knee to the foot, allowing an inch or an inch and a half of the material to project below the sole; he then bandages firmly to the knee. The plaster ought to be spread upon strong cloth; it is for the purpose of making extension upon the limb after the American fashion, and is much more comfortable than any other mode. It is better to leave the patient some hours before any force is exerted on the strapping, that it may establish strong adherence. When it is supposed to stick sufficiently firmly, the splint is to be placed in position; the upper portion will pass round the pelvis, the lower lie along the bed, quite

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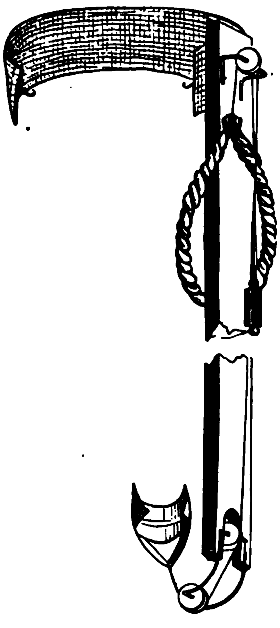
[1] "Traité de Thérapeutique des Maladies Articulaires," p. 416 et seq.; and "Méthodes Nouvelles de Traitement," &c., p. 69.

Fig. 25.



Splint for hip-disease.

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[1] The reader must be reminded that the word contraction in this sense only refers to an active condition; when muscles have been for some considerable time morbidly contracted, there supervenes a form of atrophy, accompanied by passive shortening and rigidity—contracture.

out of reach of the distorted limb. The surgeon now bandages from the foot to the top of the thigh, independent of the splint; arrived at the latter place, he causes the bandage to pass round pelvis and thigh, including all the upper portion of the splint, thus fixing it with sufficient firmness. Catgut is now to be fastened to the ends of the plaster projecting below the foot; the perineal band, properly padded, is to be adapted, and both to be fastened to the accumulator with the proper degree of tension.[1]

For the first ten minutes, or quarter of an hour, the strain should be slight; the muscles soon after its application set up a startled sort of resistance, which, however, soon subsides, and then the India-rubber is to be pulled tighter. In a very few hours the foot or knee will have descended so much that a nurse, or other person in attendance, must tighten the spring, and in from eighteen to thirty hours the limb will have come down, and may be bandaged to the thigh part of the splint. This will have been effected without pain or violence; indeed, the starting pains previously complained of will even abate under the downward traction.

If, however, the malposture be more fixed—that is, if the disease be further advanced into the second stage, the thigh cannot be thus drawn down without producing considerable pain; and in such case it will be better to give chloroform, and while the patient is under its influence, to draw down the limb into the proper position—namely, straight, and to bandage it upon the splint.

The better to consider the treatment now to be adopted, let us glance at the condition of parts. The patient has had an inflammation in the hip-joint, and there is sufficient remaining (be it much or little) to keep up a destructive process; and at the same time he has morbid contraction of certain muscles, which under ordinary circumstances produce a deformity. We have overcome the deformity, and by bandaging can keep the limb in its place.

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[1] It is not always desirable to continue extension upon the perineal band when the patient is apt to chafe (until the deformity is overcome, the force must be thus applied); the upper end of the accumulator may then be fastened to the top of the splint. A glance at the mechanism will show that the force acts both upwards and downwards; but the lower pulley being in the situation of a movable one, causes the upward to be just double as much as the downward pressure on the splint. Hence, to prevent the apparatus riding up, it is necessary to use a perineal band, fastened to the splint, but the tension upwards will be equal to only one-third of the power of the accumulator.—Mr. Bigg, of Leicester Square, has undertaken to make these splints according to my pattern.

This is the whole that M. Bonnet's, Dr. Bauer's, and all the other instruments at present used, profess to do; but, in my opinion, this is not enough. Binding the thigh to an immovable iron does not annul the contraction of muscles, but simply prevents the flexion or abduction of the thigh; the muscles still contract, and they drag the upper part of the head of the thigh-bone violently against the superior lip of the acetabulum. I have already (p. 312) pointed out that this pressure is the cause that hip-joint disease continues so long. It follows that, to enable the disease to get well, we should prevent this abnormal pressure.

Upon this principle, our plan of treatment is simple. We have only to prevent the muscular spasm from pressing these two portions of bone together, and the disease will decrease; for in the majority of cases the pristine inflammation would be subdued by the time the second stage comes on; but that it continues in consequence of the pressure. The muscular contraction which pulls the thigh up must be met by another force which will pull it down. We cannot, nor do we wish, to separate the bones, but we can so arrange that the muscular force shall expend itself upon an external object, and leave between the head of the thigh and the acetabulum no more, perhaps rather less, than their normal amount of pressure. This can be done by the extending splint, examples of the use of which shall be given; these means will not *cure* hip-disease,[1] but they will place it in the best possible circumstances for getting well. The rest of the treatment must be adapted to the peculiarities of the case; thus, there may be tension of the capsule, evidenced by heat, considerable tenderness, and swelling behind the trochanter and at the groin, accompanied by deep-seated and confined fluctuation. A few rare cases occur whose rapid course of events would justify our including them under the head of acute synovitis of the hip, in which so much strong inflammatory fever is present that we may conclude the fluid to be synovia. By far the larger proportion of diseases in this joint belong to the subacute or chronic form; the slow succession of symptoms, and the irritable hectic-like fever, rather warrant us in assuming that the fluid in the cavity is pus.

In the former instance, I would strongly recommend the application of the actual cautery, at the back of the trochanter, in two lines, so disposed as not to interfere with the application of the splint. A short line of cauterization at the groin, inside the femoral vein, has, in my experience, great effect in easing the pain, and also, I believe, in producing absorption of the effusion. If, on the other hand, the fluid in the joint-cavity be, judging from the symptoms, probably pus, we cannot hope to procure its absorption by such means, and any counter irritation will be not only useless, but positively injurious, by adding to the pain and irritable condition of the patient.

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[1] The possibility of curing a chronic inflammatory disease has been already doubted. See p. 265.

We may, however, consider whether it will not be advisable to let out the fluid. It has been shown that, at a certain period of the disease, the capsule gives way, and the contents are poured into the surrounding parts; that a period of ease then supervenes, which is generally followed by abscess. We have, therefore, this warranty in nature for such a procedure, viz., that if we do not empty the abscess, it will evacuate itself; and by drawing out the pus by means of a canula, we prevent its diffusion among the muscles, and may even check, or very much retard, the formation of external abscess. Surgery is, I believe, indebted to Dr. Bauer for this operation, and it will, as far as my experience goes, be found very valuable. In my hands it has certainly relieved pain to a remarkable degree, and the formation of abscess has seemed, to say the least, postponed. But the more extended experience of Dr. Bauer himself will afford a more reliable account of its benefits than my smaller number of cases can furnish.

"But what shall we do with the effusion in the joint? If it is of plastic character and small amount, we may leave it to resorption, and if it should organize and cause fibrous adhesions between the corresponding articular surfaces, it would matter but little, since we have it in our power to break them up again, and reestablish mobility; occasional motion of the joint in the process of their formation may even prevent them effectually; this should be done, however, with great discretion, and not before the inflammation has abated in some degree. A considerable quantity of effused material is not only a great impediment to the restoration of the position of the extremity, but it is in some respects the means of continuing inflammation by keeping up the distension of inflamed tissues. *With the quantity of exudation the degree of malposition and* *the violence of symptoms correspond.*[1] In order to relieve both we have to withdraw it. We may do this in two ways, with knife or trocar. A straight and pointed tenotome is flatly inserted behind the joint, then so turned as to penetrate the capsular ligament. The wound of the latter should at least be a quarter of an inch long, so as to facilitate the escape of the fluid. Whilst this is being done the extremity should be inverted so as to diminish the size of the articular cavity so as to drive all the liquid out. The punctured wound, in fine, should be carefully closed with adhesive straps, and the limb fastened on the wire apparatus. We should proceed in a similar manner with the trocar, with this difference, however, that the canula remains in the joint until the limb has been inverted. The limb should be kept in this position until the canula has been removed, the wound closed, and itself fastened down in the wire breeches, otherwise the formation of a vacuum would invite the air to rush in and cause mischief. The exact place to enter is to be determined by the fluctuation, mostly an inch posterior and superior to the great trochanter, where the joint is but little covered by adipose tissue and fascia. We prefer a fine trocar, of about a line thick, to the knife, as you are more certain in its handling, and as you can see the contents withdrawn, which will not only perfect your diagnosis in reference to the actual condition of the joint, but will afterwards guide you in reference to the plan of treatment to be afterwards pursued."[2]

Third Stage.—The rapidity with which shortening comes on depends very much upon the treatment during the second stage, and upon the posture which the patient assumes or is made to take.[3] If the position which produces an apparent shortening of the thigh be induced by the irritating pressure of one bone surface against the other,[4] we may, by preventing such pressure, be able to postpone, perhaps even altogether avert, the assumption of that attitude. There are cases which in spite of every treatment will run on to abscess; but even these will not get deformed to such a degree if extension be applied early, and even when the third stage has lasted a considerable time the shortening will be very much diminished.

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[1] This statement (the Italics are Dr. Bauer's) is hardly to be applied, in its whole extension, to many joint-diseases with violent symptoms.

[2] Bauer "On Hip and Knee-joint Disease," p. 28.

[3] Refer to p. 310 for account of posture.

[4] See p. 312.

If a patient in this phase of the disease be allowed to assume what position he chooses, or even if he have a splint upon the limb but not any extension be exerted, the starting pains become extremely severe in character—produce, even during fitful slumbers, profuse perspiration, wear out the health, and cause rapid wasting with hectic fever. M. Bonnet was, and Dr. Bauer is, in the habit of performing myotomy pretty freely for the relief of these spasms. I too have found such operation efficacious, but do not expect again to be forced to its use for such purpose. The contraction of the muscle is not prevented by its division, for it depends upon nervous irritation which continues after myotomy; as the operation relieves pain it is evident that this is not caused by the contraction itself, but by something that the contraction produces. The posture caused by the contraction may be overcome, but the pain, if nothing else be done, will continue; it is not, therefore, the posture which is painful. There remains only the other effect of the muscle, namely, the abnormal pressure upward of the thigh-bone; by relieving this, myotomy annuls the spasm. But division of a mass of muscles like the adductors is not to be undertaken lightly, not merely on account of its size, but also on account of the position of the obturator vessels and nerves. It is true that the section is not followed by dangerous hemorrhage or paralysis; that the muscles may even be divided without severing the vascular and nervous branches; but such an operation is performed close to the capsule, and is not to be recommended during the active phase of hip-disease, although the immediate relief of pain is gratifying. Myotomy, however, is a justifiable procedure if the case come under treatment when the disease is already far advanced, when the muscular contraction has lasted a long time, and the deformity is too considerable to be overcome even by a powerful extending force under chloroform; we shall be obliged in such cases to divide the muscles. The principles of such operations fall under another heading, but it may here be stated that it is not wise rapidly to extend a limb, particularly of a child, if the deformity be so great that the contractured muscle must be considerably stretched. (Chapter XVII.) Hence, in long-standing cases, myotomy may be used to place the limb in the proper position.

The above mode of reasoning upon the cause of relief from myotomy, and the examination of a great number of morbid specimens, led me to the belief that the evil effects of muscular contraction might be overcome by counteracting their power, and induced me to construct the extending splint for that purpose. The results have exceeded my hopes, and in no case where it could be applied has it failed to relieve the starting pains. In three cases, in which the health of the patients was giving way rapidly under their sufferings, sound sleep and appetite were restored and fever disappeared. In one instance, the treatment of which I undertook when an abscess was presenting on the inside of the thigh, the shortening much decreased and the pus disappeared. Extension may not cure a chronic caries of the hip-joint, but it follows out the most reliable of all surgical indications—it removes a cause of the disease. It has already been questioned whether we can ever do more in a chronic inflammation than put the patient into the best possible circumstances for getting well, and this is done I believe by removing the morbid pressure of the one bone against the other.

All cases of caries are so slow, both in their morbid and reparative acts, that when once this process has begun (evidenced by starting pains of some duration) the surgeon must arm both himself and the patient with much endurance and perseverance, and the former must not expect that a few weeks' freedom from pain is an evidence that the patient is well. Months rather than weeks are required for the cure; when all pain, tenderness, and swelling have ceased for some time, the apparatus may be discontinued by degrees: first, the extension removed for three or four days, then, also, during the night; if no pain follow, the splint may be taken off, the limb and hip carefully rubbed but not flexed; after another lapse of time passive motion can be carefully employed. In a few days the patient may sit up, and after further interval, may move about on crutches; but if at any time in the course of these experiments any pain in the hip-joint or knee recur, the splint must be again applied and another period elapse before any attempt at its discontinuance be repeated. The extension need not be reapplied unless startings or tenderness reappear, for that condition weakens the muscles more entirely than any other, save paralysis. Even if pain do not return, a long time should elapse before he is allowed to place more than the mere weight of the limb upon the ground. It is to be remembered that the formerly carious part is now a cicatrix, and like all new tissues, will fall most readily into disease until its organization be firmly established.

A certain number of cases will, in spite of every treatment, run on from bad to worse; these belong chiefly to that less common form of morbus coxæ which began in osteitis. In such cases, although by relieving pressure we may prevent the starting pains, abscesses will nevertheless form among the muscles of buttock and thigh, or on the pelvis, or in both situations, and ultimately destroy the patient's health. In such cases excision is the only resort; this subject is handled in another Chapter (XVIII.); but it may be here remarked, that this operation is in my belief usually postponed too long, and that it should not be so much regarded as an ultimate resource to be employed only because amputation is worse than useless; it should rather be viewed as a means whereby we may yet procure for our patient a valuable limb.

CASES OF THIS DISEASE.

CASE LIV.—George Corner, aged 9, came into the Charing-Cross Hospital, 17th July, 1860, under my care (through the kindness of Mr. Hancock) with hip disease.

Five months ago some pain and difficulty in walking came on. The pain was in the hip, and it caused him to limp. The lameness got worse; and, in about three weeks after its first coming on, he could not walk at all, but remained nearly always in or lying on the outside of the bed; sometimes he could sit up. After six weeks or two months he was able again to walk, but very soon got tired, and then he was obliged to limp a good deal. A fortnight ago the pain became much worse, and he has been in bed since that time.

The thigh has now that posture called lengthening; and it gives him pain to stand, although he puts no weight on the limb. There is some swelling, and a good deal of tenderness, both behind the trochanter and at the groin. It was about a fortnight ago, as near as he can remember, that starting pains first commenced. He says that they now waken him up often when he is falling to sleep: this does not occur every, but very nearly every, night.

A blister was ordered behind the hip, and when this healed another was applied to the groin. Neither application appeared to produce benefit, and the starting was getting worse.

July 24th. I applied the splint as described at p. 326, and gave the accumulator but a slight degree of tension. Ordered iodide of potass mixture three times a day.

31st. The circular bandage, whereon extension is made, seems very apt to gall the skin; by changing its position from ankle to knee any but slight inflammation has been prevented. He has had no startings since the 26th—sleeps and eats well.

Aug. 13th. He has had no starting pains; in fact, no pain at all, and is inclined to be unruly, jumping up in bed, sometimes getting out of bed altogether to play with other boys in the ward. In consequence of this I fastened a bandage round the pelvis and to the bed on each side.

27th. Still free from all pain. On examination of the hip no swelling nor tenderness could be found, either at the groin or behind the trochanter. The tension was discontinued, and the splint only employed.

Sept. 10th. The splint was taken off on the 30th of last, and he was kept as much as possible in bed till the 7th of the present, month. He has since been allowed to walk about, which he does without limping or any stiffness. Discharged.

Case LV.—James Tosh, aged 5½, came into Charing-Cross Hospital, under Mr. Hancock's care, 1st May, 1860, with a disease in the hip-joint, which has continued since January last.

Mr. Hancock treated the boy by means of a seton, under which he improved. Some time after it was taken out he relapsed, and he had an issue applied: but in spite of all this he got worse. On the 14th of June, I, having used for a month the extending splint upon a case in private practice, requested Mr. Hancock to allow me to apply it upon this child. With his usual kindness he consented, and placed the case under my care.

June 14th. The following was the state of the disease at this date: The child complained of great pain over the inner condyle of the femur, and could only rest with the thigh and leg supported upon a small double inclined plane. Any movement made him cry violently. At night he always seemed in great pain, and cried frequently for hours before he could be got to sleep. There was much tenderness, and some heat and swelling, both in the groin and behind the trochanter. The limb had assumed the position of shortening; but it seemed that this had only just come on. During the last ten days the child's appetite and health have much declined; indeed, all the more violent symptoms date from about a fortnight ago.

I put on a splint made entirely of wire-gauze; the thigh-piece was fastened on the pelvic portion, at such an angle as to allow some flexion of the hip. Extension was made from a well-padded strap of webbing above the knee.[1]

25th. The child appears better—he does not cry at night, but sleeps well. I changed the angle of the thigh-piece, bringing the limb straight with the pelvis. The child is still in pain if the limb be rather suddenly moved, and there is still tenderness behind the trochanter. Putting the limb down caused no pain at all, as it was done slowly—no muscular contraction.

July 16th. The child is better, can now bear the limb to be moved about pretty freely; the movement which causes pain, when rather quickly done, is flexion. It has once or twice happened that the fastening of the accumulator has slowly yielded; when it becomes loose the child is always in pain.

Aug. 13th. Goes on well. One day last week some visitors gave him unripe pears, and the bowels have been much purged ever since, and he is occasionally sick. This has made him pale and languid, otherwise he goes on well. It has been difficult to prevent his being galled.

Sept. 17th. He has got much stronger and better; is taking iron. I have now replaced the wire thigh-piece by a wooden one, and make extension from strapping plaster applied along the leg.

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[1] Subsequent experience in the use of this splint has shown me that it is not necessary thus to change the angle of thigh and pelvic portions, but that it may be applied as related at p. 326, unless, perhaps, when the thigh has long been considerably flexed.

Oct. 15th. Examined carefully the hip and find no tenderness and swelling, nor pain on pushing the bone upwards. Let the extension be discontinued, and three days afterwards the splint was left off, and the child allowed to sit up.

20th. The child has been sitting about for three days without sign of pain; but to-day he would not get up, and cried with pain in the knee; splint and extension reapplied.

Nov. 14th. He is now up, can crawl about, lift his foot up to his forehead, but the limb is too weak to support weight.

Other cases might be added to these, but they really present few points on which to observe, as the simple history is comparative or entire freedom from pain; improvement in health; gradual reduction of the deformity.

The outline figure at p. 310 is taken from a boy, aged 13, who has since been subject to extension of the limb for the last three months. Starting pains have entirely ceased; the deformity has very much yielded; an abscess, which had presented at front of the thigh, has disappeared; he has no pain even on bearing the whole weight of the body on the affected limb. He is now, 20th November, walking about without any pain in the hip, but the leg is weak; there is hardly any malposture. In another case, in which the pains at night were excessive, the health had very much yielded, the sweating was profuse, the emaciation very great, and the discharge from abscesses and sinuses exhausting. The evil appearances yielded by degrees in the order in which they are enumerated, and the young gentleman now sits up for a few hours each day, without pain, and only has the splint, with extension applied at night.

APPENDIX.

On the Apparent Lengthening of the Thigh.

Although most of our reliable English authorities affirm, that "lengthening of the thigh in hip-joint disease, is merely the effect of the position which patients thus afflicted assume;" yet some English, and many Continental (chiefly German) authors, take a view so entirely opposite, and support their doctrine by so manifold reasons, that the subject has appeared to me as requiring further investigation.

Hunter conceived the "lengthening" to be due merely to position. Ford held the same opinion, although he has not expressed it very clearly, nor decisively. Brodie says, "This appearance is altogether deceptive, and on a careful measurement being made with a tape from the anterior superior spinous process of the ilium to the patella or inner ankle, it is found that there is no elongation in reality. The pelvis is inclined laterally, so that it makes on the side of the disease an obtuse angle with the spine."[1] Bonnet entertains an identical opinion, and explains at great length the various positions, whereby this deceptive appearance may be produced. On the other hand, Coulson considers that the limb may be really lengthened "a little more than an inch."[1] This is a point on which it behooves us to be accurate, and I will quote passages from those whose authority stands high in England, and on the Continent, in order that a full view of the subject may be before the reader; only premising, that those who consider the thigh to be really lengthened, conceive that such elongation is produced by some morbid change, which causes the head of the bone to be partially expelled from the socket, and that then the weight of the limb causes it to sink down. Rust, of Vienna, ascribed this lengthening to swelling of the head of the bone, which forced it out of the acetabulum; he quite overlooked posture, considering the whole elongation to be real. Falconer, Boyer, Bichat, Desault, and others, consider the lengthening due to swelling of the articular cartilages. Petit was the first surgeon who supposed that an accumulation of fluid in the cotyloid cavity could separate the head of the femur from the acetabulum; and Sabatier seized upon this notion, and attributed the lengthening of the thigh to this cause. Fricke[2] assumed that a relaxed condition of the muscles might cause real lengthening of the thigh. Sir B. Brodie says: "In cases of inflammation (acute) of the hip, if active treatment be not had recourse to in the first instance, there is always danger of the head of the femur being thrust outwards beyond the margin of the acetabulum, and then completely dislocated by the action of the muscles. Several cases of this kind of dislocation have fallen under my notice."[3] Be it observed, however, that he does not attribute the lengthening to this cause. Boyer, Larrey, and others, imagined that the lengthening might be produced by swelling of the ligamentum teres. A number of authors (Boyer, Larrey, Morgagni, Rust) put down swelling of the Haversian gland as one cause of the lengthening, and many agree with them, that a solid swelling pressing the head of the bone out of the cavity, may produce such distortion.

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[1] Sir B. Brodie "On Diseases of the Joints," p. 117.

Upon the other side of the question, we have chiefly Hunter, Brodie, and Bonnet, who consider the lengthening as due entirely to position. Let us now discuss, whether any of the causes above enumerated can produce a real lengthening or shortening of the thigh.

In trying to determine this question, two points must me made clear: firstly, whether any one of the causes mentioned is capable of pressing the head of the bone away from the acetabulum; secondly, whether, if the head of the bone be thus separated, the thigh will be thereby lengthened.

First Question.—That the head of the bone is very seldom enlarged, may be drawn from the fact that Rust, who was the most zealous advocate of this idea, could only quote one case in which it was shown to occur. Fricke, of Hamburg, gives one in which some very slight enlargement was said to have taken place. I have not found any pathological preparation in which the head of the bone proper, *i. e.*, the part ordinarily covered by cartilage, was increased in size. Swelling of the cartilage itself could at the most attain to one or two lines, and could not, therefore, cause lengthening of an inch or more. Effusion, or growth in the acetabulum, would then be the only causes remaining. It may very much be doubted whether a liquid effused into the capsule of the joint would accumulate at all between the bones. The most part, as Bonnet observed, of his injections in the dead subject gathered about the neck of the femur, but some, he says, was between the bones; though how he ascertained that point he does not say; at all events, while the muscles maintain their integrity and action, liquid would much more easily distend the capsule than displace the bone. A solid tumor, as a growth of granulations from the bottom of the acetabulum, would be far more capable of making place for itself between the bone surfaces, but it is to my mind very doubtful whether it could press the head of the bone the least distance from the socket. Let the position of the two lesser glutei of the pyriformis, the obturators, gemelli, quadratus, and upper part of adductor magnus—the strength of all the upper and anterior part of the capsular ligament, be considered; and let it at the same time be remembered that neo-plasms do not push aside parts which are in any degree firmly fixed, but simply produce their absorption. Hence it appears that none of these causes could operate in pushing the head of the bone from the socket. It is only due, however, to the high status of Edward Weber, of Bonn, to say that this opinion is diametrically opposed to his. The experiments, whereby he seemed to show that atmospheric pressure keeps the femur in its place, have been already detailed (see p. 33); a corollary that he draws from them is worthy of quotation.

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[1] Coulson "On Diseases of the Hip," p. 10.

[2] "Annalen der Chirurgische," Abtheilung des allg. Krankenhauses in Hamburg, 2ter Theil, S. 29.

[3] Sir B. Brodie "On Diseases of Joints," 5th edition, p. 54.

"We have seen in the experiments above described, that as soon as air was allowed to enter the cotyloid cavity over the caput femoris, the head fell out of the acetabulum, no change in the ligament having taken place. It is not necessary to the production of this effect, that the substance should be air penetrating from without. It may equally well be a fluid accumulating there by secretion from the vessels, or a solid substance growing in that place. In the same degree in which such fluid or other substance forms and increases in the cavity, will the head of the bone sink by its own weight, out of the acetabulum, without the necessity of any pressure, and without encountering the smallest resistance from the ligaments."[1] Surely, if even this theory of synovial vacuum were correct, such an ignoring of muscular action and ligamentous resistance cannot be admissible. The presence of either fluid or new growth would not destroy the vacuum, if any such existed, so that the new material would place itself where it encountered the least resistance, and that would certainly not be between the head of the thigh and the pelvis. However, this assumption is best refuted by some experiments to be detailed below.

Second Question.—Let it be supposed for the present purposes, that in some instances, however rare, the head of the femur may be pressed outward by an internal force, will such change in position alter the length of the thigh? The direction of such displacement is outwards, and a little downwards, but so little in the latter direction, that it may well be questioned, if a separation of an inch between the two surfaces would cause any appreciable difference in the measurements of the thigh, considering that the limb could not be dragged down by its own weight, until the head of the bone protruded beyond the lip of the acetabulum.

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[1] "Einige Bemerkungen über die Mechanik der Gelenke," &c. Ed. Weber. Müller's Archiv., 1836, p. 57.

Experiment I.—May 4, 1860.—On the body of a full grown man not emaciated; all the viscera had been removed, the thighs were forcibly flexed, extended, and moved in every possible direction, until all rigor mortis was overcome.

A needle was driven into the anterior inferior spinous process of the ilium, another into the femur, above and to the outer side of the knee-joint; an inflexible wand of wood was then procured, and at right angles to its axis a needle was driven into it; this was applied against the one in the ilium, and a fourth needle was inserted at the point of the wand, where it came in contact with the one in the femur. Most accurate means of measurement were thus procured, one whereby a variation in length to the $\frac{1}{10}$ of an inch could be appreciated.[1] The subject lying on its back upon the table, a hole was rapidly bored from the inside of the pelvis, through the acetabulum; the staff being held against the needles, showed no alteration in the length of the limb.

Experiment II.—Same day.—On the other limb of the same subject, like means of measurement being adopted. On boring a hole through the acetabulum, no difference in length could be detected; the nozzle of a syringe was then fitted to the opening, and water was injected. About three drachms probably found its way into the cavity; no more could be forced in, although considerable pressure was used; there was no difference whatever to be detected in the distance between the needle in the femur and that in the ilium.

Experiment III.—May 9, 1860.—On the body of a man who died of old age. All internal viscera were removed, rigor mortis of left hip entirely overcome by forcible flexion, extension, &c. Needles driven in as for Experiments I. and II. The reverse surface of the acetabulum was pierced (measurement showed no consequent change in the distance of the needles), and enough of the bone was cleared away to permit the easy introduction of the tip of the little finger, wherewith the smooth head of the bone could be felt: synovia flowed. An iron screwdriver was inserted between the acetabulum, and the head of the femur, and then turned, so as to lie with its greatest breadth between them; this visibly moved the trochanter outwards, but made no difference in the distance of the needles. A wooden wedge was then driven between the two articular surfaces (the back portion), by successive blows of a mallet, till the mass inserted equalled $\frac{8}{10}$ inch. This caused visible projection of the trochanter; it was hardly possible to obtain any sufficiently accurate measurement of the amount of projection, since from simultaneous rotation inwards, the relative position of ilium and trochanter was altered. At all events, it was known that a mass of wood $\frac{8}{10}$ of an inch thick intervened between the head of the femur and the acetabulum. The distance between the needle in the spine of the ilium and that in the lower part of the femur remained accurately the same as before the wedge was inserted. The skin seemed to drag a little on the lower needle.

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[1] The difficulty of measuring the thigh can hardly be understood by any who have not directed much attention to that subject. The obstacles which are encountered on the living in comparing one side with the other, of getting the two thighs in exactly the same relation to the pelvis and at perfect right angles to the axis of the body, render measurement of limb against limb most uncertain. Needles were chosen as fixed points because all processes of the bones are too broad to serve as accurate objects of measurement, and they were fixed into the bone because the mobility of the skin destroys nicety of appreciation.

This last experiment is far more decisive than the other two, but certain defects might be supplied. In the first place, the weight of the femur, always supposed to aid in the lengthening, could not act. In the next place, the lower needle seemed a little dragged on by the skin: this appearance was very slight, it may have even been fallacious; but such draft might have been produced by one of two causes: either the thigh-bone was really pressed downwards by the wedge, but the tension of the skin would not allow the needle to show that descent; or the projection of the trochanter had pulled the skin upwards, and thus produced a drag upon the needle. Again it certainly would be advisable in the next experiment to obtain some measurement of the outward projection of the trochanter. Moreover, in the preceding trial, the wedge had been driven in behind, and a little below the trochanter, and this position may have prevented the descent of the thigh.

Experiment IV.—May 10, 1860.—On the right hip of the same subject as the last, placed upon its back upon the table; all *rigor mortis* was overcome by forcible flexion, &c., of the thigh. A measuring tape was fastened by a flat-headed nail to the last spine in the sacrum, so that it would be carried round the ilium, including the trochanter, to a needle in the symphysis pubis: this measurement was exactly twenty and a half inches. At the edge of the measuring tape, another needle was knocked into the trochanter, which was to serve not only as an index, but also as a means of securing the same position of the tape at the next measurement. Needles were fastened into the inferior anterior spine of the ilium, and in the lower part of the femur as before. Incisions were made down to the bone previous to inserting each needle, so as to leave them free on all sides. A strap, fastened round the ankle, held a ring which permitted a system of pulleys to be hooked upon the limb. Counter-extension was made by a rope passed under the perineum. When all things were ready, and the measurement by staff accurately procured, a system of three pairs of pulleys was hooked upon the limb, and upon its rope a weight of 28 lbs. was fastened; this procured an extending force of 756 lbs., or 6¾ cwt. There was a gentle crackling in the whole limb, but the measurements were precisely the same. Ten minutes were now allowed to elapse, and the weight was seen gradually to sink down towards the floor; at last the stretching of some part of the extension and counter-extension (either limb or rope) was so great that it was necessary to fasten the weight higher on the cord. The measurement between the needle in the ilium and that in the femur was now again taken, and no difference was found; thus the weight had in no degree lengthened the thigh, *i. e.*, it had not increased the space between knee and pelvis. The cotyloid cavity was now pierced from the pelvis: measurement still showed no difference in the distance of the two needles. A considerable portion of the inner wall of the acetabulum was gouged away, as in the last experiment, and a wedge three-quarters of an inch in breadth was driven in above and a little behind the head of the femur. This caused the trochanter visibly to project: the measurement round that side of the pelvis and great trochanter was within a fraction of twenty-one inches. There was found, in the distance between the needle in the great trochanter and that in the symphysis pubis, a decrease of nearly two lines;

this was attributable to rotation inwards; but between the needle in the inferior spine of the ilium, and that above the knee, no difference in length could be detected. A wedge, just one inch broad, was now driven in directly behind the head of the femur; when it had got nearly home, considerable power was used, and the trochanter was seen to project further at each blow of the mallet, and the needle which had been driven into it, turned like an index more and more towards the ilium. At last the trochanter projected so much that the iliac fossa and belly of the gluteus medius formed a deep hollow; the measurement round the ilium and trochanter was now 22¼ inches; the needle in the trochanter was a fraction of a line *nearer* to the one in the symphysis pubis, showing how great rotation inwards must have been. The measurement between the needle in the anterior spinous process of the ilium, and that in the lower part of the femur, remained precisely the same.

The wedge was withdrawn. The head of the bone did not return to its old place. The weight was removed from the cord. The head of the bone fell back—not suddenly, but still pretty quickly—into the socket, producing a remarkable sound precisely like that of disarticulation. The measurement in length, of the femur, was found precisely the same as before and during the trial.

These experiments set at rest the supposition of any real lengthening of the thigh being possible without dislocation. Such results are consonant with reason; but I should hardly have conceived that a separation of an inch, with such great projection of the trochanter, could have made *absolutely no difference* in length, although I expected to find that difference very small. We must then look entirely to position, as the cause of this important symptom.[1]

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[1] This last experiment was referred to in Chapter I., p. 34, by an error, as Experiment III.

CHAPTER XV.

ON AFFECTIONS OF SYNOVIAL SHEATHS AND BURSÆ IN THE NEIGHBORHOOD OF JOINTS.

THE synovial membranes which line tendons and their sheaths, or which form fluid pads between the skin and bony points exposed to friction, also between tendons and the subjacent bone, in every case where the former passes over a tuberosity to be inserted at its further side, are all subject to inflammation.

The Bursæ, as these latter bags of synovial membrane are called, are thus to be found in certain points of the body in a normal condition. Some are superficial, others deep. To the former class belong the sac between the skin and olecranon process, and that between the same structure and the patella with its ligament, &c. &c.; to the latter, the bursa between the biceps tendon and tuberosity of the radius, between the ligamentum patellæ and tuberosity of the tibia, between the tendo-Achilles and os calcis, &c. &c. But if, from deformity or other cause, any point be exposed to unusual friction insufficient to produce ulceration of the skin, a bursa in that point will be formed. Thus, one will arise on the outside of the foot in talipes varus, if the person walk about; in angular curvature of the spine, a bursa is developed between each projecting spinous process and the skin; and many other such instances might be given. The various facts and investigations upon this production of new bursæ show that they are formed from the common areolar tissue; that there is no structural difference between them and the bursæ normally found in the body; and, therefore, it may well be assumed that normal bursæ are produced by the friction which they are developed to prevent.

The inner lining of these sacs is not smooth, but covered by fringes, like, but smaller than, those in joints; moreover, fibrous bands, running along the wall, project into the cavity. The outer part is simply condensed areolar tissue, and is continuous with that structure on all sides. If the bursa be subject to considerable pressure, its outer portions will become more condensed, till they assume a fascia-like appearance and hardness.

Any bursa of the body is liable to become inflamed, and the attack may be either acute or chronic; even the acute disease may be simply one which causes increase of normal secretion and thickening, or it may be suppurative. Fortunately, suppuration of a synovial bursa does not often arise spontaneously, except in the subcutaneous sacs. I have never been able clearly to ascertain such action in any deep bursa, although in certain cases of deep-seated diffuse suppuration I have considered a synovial sac the probable birthplace of the disease. The purulent inflammation is usually produced by a blow, or some external violence, acting upon a much-debilitated constitution. The action is not confined to the bursa itself, but is of a diffuse form, and attacks the areolar tissue continuous with the bursal walls. The general symptoms are precisely those of the "diffuse inflammation of the cellular tissue"—of what used to be called "phlegmonous inflammation," viz., a brown, dry tongue, heat of skin, sleeplessness, and a weak, quick pulse. The local symptoms differ only in this, that in the phlegmonous inflammation the pus can only be diffused into the areolar meshes; in bursal suppuration a cavity exists wherein a good deal of the pus is always collected, and thus we have the local symptoms of a circumscribed abscess combined with those of a diffused one. The skin at the inflamed part is of a dusky red; the color has no sharp boundary, but fades gradually into the normal hue of the surrounding skin. The swelling is more or less conspicuous, according to the size of the bursa, its superficial position, and the stage of the inflammation. The heat is very considerable, and the pain is great, as long as tumefaction continues and tension be not relieved. If the case be suffered to go on, as sometimes happens, without any adequate treatment, typhoid symptoms develop themselves, and the state of the patient may become critical; absorbent inflammation, greater and greater debility, ultimately prostration, with low, muttering delirium, will shortly be followed by death from exhaustion or purulent infection.

Free incisions through the whole reddened portion of the skin, profound enough to include the deep side of the bursa; poultices, mixed with charcoal or yeast, or chlorinated soda, is the fit local management. The general treatment should be stimulant and tonic. Bark and ammonia, quinine with ether, chlorate of potash, or other such medicine, combined with opium and camphor, or opium and chloric ether, at night; wine, brandy, or, in those accustomed to it, gin, may all, in the worst cases, be needed. It is generally advisable to give, before resorting to any of the above means, a brisk purge; but this is certainly not always desirable. Our power over the intestinal mucous membranes is often very much abused, and in few ways more than in first attacking all patients with a drench. A little judgment in considering the condition of the tongue, the aspect of the conjunctiva, and the state of the abdomen, will guard us against such errors. To purge a patient with bursal suppuration, who does not need such treatment, is to inflict upon him an absolute injury, by weakening his powers of resistance to disease.

When the patient recovers from the depressed condition, the wound made into the skin and the walls of the abscess begins to granulate, and to throw off any sloughs that may have formed. Among these must be included the whole bursa. It comes away in white soaked shreds of dead material, not one portion retaining any life, and remaining behind. After a time, even before all the sloughs have separated, the poultices may, if the skin and wound look sodden and inactive, be changed for a dressing of dilute nitro-hydrochloric acid; and when the sloughs have entirely separated, lint dipped in cold water; or if the granulations be flabby, and the discharge considerable, a solution of alum (from ten to twenty grains in the ounce) may be advantageously employed. As the bursa, particularly when swollen, occupied considerable space beneath the skin, a cavity will be left, in which matter will collect, unless its sides be kept together. It is, therefore, necessary to apply some pressure by means of pads, with a bandage or strapping plaster.

Subacute, or chronic and non-suppurative inflammation, may attack either a superficial or a deep bursa, and though the disease will not lead to such violent symptoms as the pus-producing malady, it causes frequently considerable pain and inconvenience. When the bursa thus affected is superficial, the nature of the disease is easily discovered [illegible] its treatment, if the attack be recent, by blisters, or iod[illegible] form of counter-irritant, is as obvious as it is in ge[illegible] The disease known as housemaid's knee is the [illegible]ample of this complaint. It consists in an inflam[illegible]argement, at first through mere effusion of synovia, then also through thickening of the bursa between the skin and the patella. The disease is brought on by the necessity, which women thus employed labor under, of kneeling a great deal and of moving about on the knee, and when the bursa becomes thus affected, the pain of such occupation is very considerable. Recent cases, in which the walls of the sac are not yet much thickened may be advantageously treated by blisters, or other counter-irritant. I have frequently cured such tumors by passing a long-bladed tenotomy knife for some distance through the skin and dividing the bursa as widely as possible subcutaneously. Injections with an alum solution, or with iodine, may also be employed. If the walls of the bursa have become much thickened, however, excision is the only remedy. Two years ago I cut out what had been a bursa in that situation, but was then a thick hard lump of a fibro-cartilaginous material, with a small space in its centre containing a yellowish transparent jelly. The bursa over the olecranon process of the ulna occasionally takes on an inflammatory action, similar in nature and cause to the housemaid's knee.

Of more surgical importance are affections of the deep bursæ, because they are sometimes apt to perplex the practitioner who is not much in the habit of examining joint diseases. A large bursa situated under the deltoid muscle is not unfrequently the seat of a painful affection. It usually is produced by some slight accident—a strain of the arm, or fall on the shoulder, and I have seen it combined with fracture of the clavicle. The inflammation may be subacute or very slow and chronic, and in either case may somewhat assimilate a synovitis of the shoulder-joint. The distinction is to be found in the greater protuberance of the deltoid muscle, and the perfect maintenance of the groove or division between the deltoid and pectoral muscle—that is, between shoulder and chest. Passive movements of the limb, and the active movements as long as the arm hangs down, are all but painless, but as soon as the patient endeavors actively to abduct the arm the pain is excruciating. Passive abduction, on the contrary, relieves the pain. The bursa thus inflamed nearly always crepitates upon pressure. It is to be observed that this sac is said to communicate sometimes with the shoulder-joint. The occurrence must be extremely rare, but still the surgeon should remember that it may take place.

Neither the bursa at the olecranon nor that beneath the biceps tendon is likely to lead to any complication: inflammation can hardly simulate synovitis. Between the triceps and the humerus there lies a sac which sometimes is an independent bursa, but more often a prolongation of the synovial membrane of the elbow-joint. This may become inflamed, and as the exact relation of the part is in every case doubtful, it behooves the surgeon to know with what he has to deal. If this sac be an independent bursa inflamed for and by itself, the joint remaining normal, there will be no swelling or puffiness between the inner condyle and olecranon process when the arm is bent at right angles; but the infallible test is that the line of junction between the head of the radius and the humerus is as clear and well defined as ever. If, on the other hand, the inflamed structure communicate with the joint, then these parts will participate in the general puffiness and swelling. There are several small bursæ about the wrist, but we will postpone their consideration.

About the thigh are situated bursæ whose inflammation may distantly simulate joint disease. That one, which is placed beneath the psoas and iliacus tendon, occasionally becomes thus inflamed, and produces very considerable pain at the top and inside of the thigh in front of the origin of the gracilis muscle; it may even become sufficiently enlarged to cause in a thin person visible swelling in the groin. This sac sometimes communicates with the synovial membrane of the hip-joint, and then that entire structure will join in an inflammation which may have begun only in the prolongation; the symptoms of hip-joint synovitis will then of course be found. Usually, however, the bursa is separate, and then the pain and tenderness will be limited to the upper and inner part of the thigh and the groin; there will be no pain, no tenderness, and no swelling behind the trochanter. This sac generally owes its inflammation to some accident—a fall or a slip throwing the leg outward—and if this occurred in an aged person it may at first lead to the supposition that the neck of the thigh bone has been broken; it is well known how difficult it is to detect an impacted fracture of this bone; it is therefore wise not to attribute this pain at the origin of the adductors (which is also present in that form of fracture) to the slighter malady, until the absence of a graver injury be entirely ascertained. The great pain produced by an inflammatory affection of the psoas bursa may be set at rest by flexing the thigh on the body, and rotating it somewhat inwards; the patient should be kept in this posture for some days, and a counter-irritant be used. Blisters are in this spot hardly applicable, and in delicate-skinned persons I have known even the tincture of iodine produce a too violent effect and intense pain. I have used with advantage the nitrate of silver lotion (see p. 145), which does not blister and crack the skin like iodine. If the patient be seen immediately after the injury, a hot hip-bath will afford great relief.

The large sac, situated beneath the tendon of the triceps and crureus muscle above the patella, is most commonly a prolongation from the synovial membrane of the knee-joint; this structure, as is well known, rises up on the femur in some persons much higher than in others, and when the cavity becomes distended with fluid, as in hydrarthrosis, it reaches further than under ordinary circumstances. Occasionally, even when there seems a separate bursa above this prolongation, the partition between them will be found incomplete; in a few instances the bursa is really separate. The diagnosis between inflammation of the synovial membrane and of the sac when distinct is easy; particularly while the patient is in the erect posture: swelling and fluctuation on both sides of the ligamentum patellæ mark the former disease; limitation of these symptoms to a space above the patella, and perfect contact of that bone with the femur, the latter. Of the two bursæ situated the one over, the other under the ligamentum patellæ, mention has been made, and inflammation of the former has been described; the same disease occasionally attacks the deeper sac, and I have in two instances known it to be mistaken for commencing osteitis of the head of the tibia. It produces a dull pain, aggravated by exercise, and a certain swelling of the part which looks as though the tuberosity of the tibia were abnormally developed. Limitation of the pain and tenderness to a small spot just above the greatest protuberance of the bony process beneath the tendon, is sufficient to mark the nature of the disease; and its ready yielding to slight counter-irritants will confirm the diagnosis.

Children between the ages of six and fifteen frequently suffer from a dull aching pain at the back of the heel, increased by exercise; grown people may also experience the same inconvenience—chiefly after having worn a boot which presses on the part. It arises from inflammation of a bursa situated between the tendo-Achilles and the upper part of the tuberosity of the os calcis. The malady is only of importance as a disease to be distinguished from osteitis.

Tendinous sheaths.—Many of the tendons, chiefly those of the hand and foot, are surrounded by so called sheaths, consisting internally of a fine synovial bag folded round the structure, and generally protected by a dense fibrous membrane; certain tendons are isolated each in a separate sheath, others are grouped together, one sheath sufficing for the whole number. The synovial investment usually projects beyond the fibrous protection, chiefly at the distal end. The structure of the synovial tissue is similar to that of the joints—it is very fine, and the fringes on its inner surface are less developed than in articulations.

These synovial sacs are liable to inflammation, which is not unfrequently suppurative; the disease gives rise to very acute pain and to swelling in the part, and if it be allowed to continue without relief it causes in the surrounding structures an inflammation, generally phlegmonous, with great tendency to run along the absorbents; such a malady frequently occurs in the fingers, and requires, as is well known, free incision, poulticing, and support to the general system. A similar condition sometimes arises in the palm of the hand, and those extremely painful suppurations beneath the plantar fascia generally originate, I believe, in a tendinous sheath. When the large synovial structure in the palm suppurates, there is usually a great deal of constitutional disturbance with considerable pain, and the inflammation is very apt to spread up the arm. If this condition continue sufficiently long unreduced, the tendons may slough; as in any other sheath, suppuration is apt to cause death of its contents; it is therefore necessary, in acute cases, to incise the swelling along the whole length of the palm; even this is not always enough, for, although the bag is only one, it forms, by its reduplications, three sacs; one between the superficial tendons and annular ligament, another between the superficial and deep tendons, a third between this latter set and the anterior carpal ligament. The sac stretches from the palm, extending lowest along the tendon of the little finger, to above the annular ligament; so that when it is filled with fluid the swelling is in both the palm of the hand and the wrist, there being between its two portions a division or constriction formed by the above-named ligament. When the suppuration is very acute, it is necessary to open the sheath from end to end, cutting fearlessly and deeply through fascia, sheath, annular ligament, and even letting the knife pass among the flexor tendons; by such means only can we save the part. Sometimes, however, the suppuration is not so violent but that it will admit of a less heroic treatment.

Mrs. Godwin had sprained her hand very severely by over-exertion, and three weeks afterwards, having continually got worse, she came to me at the Charing-Cross Hospital. The palm of the hand was much swollen and red, also at the wrist was a red puffy fluctuating tumor: she was suffering considerable pain; the fingers were semiflexed; movement, particularly of the three inner fingers, was exceedingly painful, that of the index less so; the thumb could be moved with but little inconvenience. The appearance of the hand was peculiar, swollen at the palm and wrist, while between these parts the tumor was deeply bisected; it at once suggested fluid in the flexor sheath; the fingers of one hand placed on the carpal swelling, those of the other on the palmar, detected fluctuation between the two; and when the latter alone was pressed, the former visibly enlarged. The constitutional disturbance was not great, but was sufficient, combined with the redness at the wrist, to lead to the conclusion that the fluid in the sheath was pus. I incised the carpal swelling from the edge of the annular ligament upwards; made a large hard pad of tow, and bound it with great force in the hand; placed the arm on a splint, with the wrist bent backward, so as to obtain as much pressure as possible from the flexor tendons on the the deep reflexions of the sheath. Three days afterwards I saw her again: the discharge had been at first profuse, but was now diminished; she complained a little of the position and pressure. The palmar swelling had nearly disappeared. In a week I was able to use a smaller pad; and in a fortnight the discharge had ceased, and the wound was beginning to heal. I continued the pad and splint for three weeks, after which a bandage, with simply a few folds of lint in the palm, was substituted, and in a month the hand was restored, stiffness from confinement only remaining. During the first part of the treatment she took quinine and stimulants; afterwards the latter remedies were discontinued.

Now, although it would be a grievous error to neglect to make deep and long incisions through the palmar fascia and ligament, when such treatment was necessary, yet would it also be mistaken surgery to cut into the palm if the disease could be otherwise treated; for when the palmar fascia has been wounded it contracts on healing, thereby dragging on one or more of its attachments to the phalanges, and tending to bend permanently some of the fingers. The judgment of the surgeon must be founded on the amount of swelling and of tension, the rapidity with which the pus has formed, the tendency of the inflammation to run up the arm, and the amount of constitutional disturbance. In rapid cases, and those in which the system sympathizes materially, the palm must certainly be opened, particularly if there be the least sign of absorbent inflammation; in slower cases an incision above the annular ligament, with considerable pressure in the palm, will suffice.

A sprain includes all injuries produced by forced displacement of an articulation short of dislocation; and, indeed, a partial dislocation may have actually been present while the force acted, replacement occurring as soon as it ceased. Such an extreme case of sprain is usually, if not always, accompanied by more or less rupture of ligaments, even of tendons, and is succeeded by acute synovitis. A milder application of force may rupture a few fibres of one or more ligaments, tear the areolar tissue, and some of its small vessels, besides causing bruise of the tendinous sheaths; a still less powerful injury may only produce the last effect. A sheath is most liable to be bruised when the tendon which it contains is bent at a right angle, so that the muscle acting powerfully forces the curve of that structure against the delicate synovial membrane. This is very much the case in the foot, where most tendons, both anterior and posterior, are thus bent; also at the hand, when the wrist being forced backwards the extensor muscles would drag the tendons into a straight line, were they not confined by the sheaths; the force necessary to resist this tendency produces the bruising. This is, of course, followed by inflammation. A good knowledge of anatomy, and of the actions of muscles, will lead to an accurate diagnosis, if the surgeon will take the pains to observe that those positions which put the injured tendon on the stretch are painful; those which relax it painless. In all cases the painful active movements will be the opposite to the painful passive ones. To diagnose the condition of the ligament it is necessary to produce a passive movement that shall render that structure tense without implicating the neighboring tendon. An example will show at once what is meant. Let us suppose a sprain, with pain and swelling behind and beneath the internal malleolus. If the tendons of the tibialis posticus and flexor digitorum muscles be sprained, passive flexion of the foot is very painful, while passive extension is comparatively painless. Active movements are contrary: the patient can scarcely point the foot and toes downward from extreme pain, but can raise it upwards with relative ease. If the surgeon, keeping the foot at right angles to the tibia, endeavor to turn the sole outward, he puts the internal lateral ligament on the stretch without influencing the tendons, and the presence or absence of pain during such operation will enable him to judge the condition of that structure. The same mode of diagnosis, adapting the movements and positions to the particular joint in question, will always reveal the nature of the accident. It must be remembered, however, that all bad sprains are compounded of tendinous, ligamentous, and often joint injury.

It is much easier, there can be no doubt, to recover perfectly from a simple fracture than from a bad sprain, which implicates the ligaments; but the tendinous, or rather the sheath injury, of which we are now speaking, is not generally difficult of cure. We have to do with a thin synovial membrane lying generally near the surface. If the sprain be seen early enough, a local bath of hot water, kept for an hour at as high a temperature as can be borne without actual pain, will greatly relieve, if not altogether cure, this form of complaint. Subsequent rest, with counter-irritants, or pressure, or both, will remove whatever inflammatory condition may still linger, if, at the same time, rest of the part be strictly enjoined. The great cause why a sprain, of the ankle for instance, often lasts so long is, that the sufferer walks about before the inflammation has been subdued, and so keeps up the morbid action, while a few days' more rest would suffice for the cure. Another cause of the long continuance of the inflammation is, I believe, a bad choice of counter-irritants. When it is desired to affect, by such means, a part far from the surface, a slow, deep-biting application is desirable; when, however, the inflamed texture lies close to the skin, such a counter-irritant adds to, instead of drawing from, the original evil; and I am sure, that I have seen iodine reproduce inflammation of, and effusion into, superficial tendinous sheaths. A much better application is a mild and oft repeated sinapism, a flying blister, the nitrate of silver lotion, which affect little more than the surface. When the inflammation has subsided, and all that is wanted to complete the cure is, that the sheath should regain its natural size and form, pressure is a most valuable means; whether this be effected by the bandage or by strapping, it should be recollected that the natural hollows of the part must be filled out by pads. If, for instance, the ankle be strapped and the hollows beneath and behind the malleoli be not thus padded, the application will surely do more harm than good, particularly if the ligaments, or tendons there situated, be implicated.

The mildest form of a recent, and more or less acute, inflammation of the synovial sheaths is that which Velpeau first described as painful crepitation (*crepitation douleureuse*) of the tendons. It appears to arise from the application of too much force, not violently, as sprains are caused, but from a slow and gradual exertion of only a slight superabundance of power: thus, washerwomen are very subject to this complaint after a hard day's work wringing out linen; young ladies, after practising several hours at the piano, also are apt to contract the affection. It is altogether more common among women than men. It appears to consist of an inflammatory condition of the sheaths of the tendons whereby their villi are exaggerated and their inner surface roughened. It hardly occurs except in the extensor tendons of the fingers, sometimes in those of the toes.

The symptoms are—an indefinite pain, on any movement of the parts governed by the affected tendons, in the worst cases, even when these are still; it sometimes continues during sleep, so that the person, being aware of uneasiness, dreams and enjoys no sound slumber. There is very seldom any redness over the part. If the surgeon hold the limb in his hand and make the patient bend and flex the fingers or toes, as the case may be, he will feel a peculiar creaking beneath the skin—hardly a crepitus—a sort of rustling in the line of the tendons. The treatment is rest and slight counter-irritation, as by camphor liniment, the application for five or six minutes of a mustard poultice, and so on; but, in truth, the crepitation and pain will cease, if rest be allowed, without further interference, and I have sometimes questioned the benefit of any stimulant application.

Sprains, if not perfectly cured, may result in permanent enlargement and dropsy of the injured sheath, and such disease may also follow the painful crepitation of tendons; it also may arise independently of any known injury, or of any acute or painful inflammation. It consists simply in the gradual distension of the sheath, by fluid of a synovial character, until it presents a fluctuating tumor under the skin. Of course, such distension can only take place where the synovial membrane is not bound down by a fibrous sheath, hence those sacs which are thus confined protrude only at either, generally the distal end of their tough investment. The most usual situations for these fluid tumors are the back and palm of the hand, and the back of the foot. The synovial sacs in these situations invest, as already has been said, one or more tendons; and hence the swelling may either be fusiform, if the tendon be single; bifurcated, if double; trifurcated, if triple, and so on. Those which appear on the back of the hand at its inner side are single towards the wrist and bifurcated or trifurcated towards the fingers; those which arise over the index tendon are single, *i. e.*, fusiform, at either end; they are usually lobulated, being in some places bound down by stronger bands of the fascia than in others. The same appearances are found when the tendons of the extensor brevis digitorum pedis are affected. In both these situations, as the tumor is very superficial, so is it diaphanous. When dropsy affects the large sheath, enveloping the flexor tendons of the fingers, the swelling has the same bisaculated form as was described when speaking of suppuration in that sac: it presents a large tumor, part of which is in the palm, part in the wrist; it is bisected by the annular ligament at the base of and between the thenar and hypothenar eminences. The tumor may be diaphanous in the wrist, but is not so in the palm.

Very often these sheath-dropsies are multilocular, being divided into a number of cavities by membranous partitions; moreover, they frequently contain a variable number of little translucent bodies, ordinarily about the size of mustard seed, or apple pips, floating loosely in the fluid. It is remarkable that these peculiarities of division into many cavities and of corpuscular contents are much more common in sheaths of flexor than of extensor tendons. No adequate reason can be given for this predilection, we must therefore be content with simply noting the fact. Dupuytren considered the loose bodies to give in some way a lobulated form to the sac, which is in reality, however, due, as already said, to the disposition of the fasciæ which cover them; he also considered them to be hydatids; hence, tumors containing such melon seeds were named *tumeurs hydatiformes* and *tumeurs en bisac.* The account which Sir E. Home gave of Hunter's view concerning the formation of these bodies[1] may be in some rare instances correct, but there is now very little room to doubt that they nearly always originate in a hypertrophied condition of the synovial fringes in the same way as the false bodies are produced in joints.

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[1] "Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge," vol. i. John Hunter conceived them to originate in clots of blood effused on the surface of the membrane, which adhered and became organized, and then were gradually separated by friction, leaving behind them a filamentous attachment to the bursal walls.

(See p. 212.) The growths in a recent state are oval in form, and in tendinous sheaths rarely larger, generally smaller, than apple pips; diaphanous and colorless, or of an opal gray; put into spirits they become opaque and white. Examined by the microscope they are seen to consist of simple fibres ramifying in a jelly, among which an occasional cell, or nucleus, may be observed. Their presence, unless in very small quantities, may be judged from a particular sensation, which they communicate to the hand of a surgeon examining the fluctuation of the tumor, namely, a sensation of minute parchment-like crepitation, different to any other crepitation, to that of bone or to that of fluid crackling often present in enlarged bursæ. It is important to become acquainted with this feeling, because the absence or presence of these bodies influences both the treatment and prognosis of the case.

A dropsical sheath of the extensor tendons does not usually contain any melon-seed bodies, and therefore is more easily managed, than a like state of the flexors, in which such formations are generally present; often mere counter-irritation, combined with pressure, will in time disperse the former swellings; but such treatment is not invariably successful; it always occupies considerable time, and it is occasionally important to get rid of so ugly and inconvenient a tumor, trifle though it may be, as soon as possible. A subcutaneous section will evacuate the fluid; it should be made by passing a long tenotomy knife through the skin, at a distance from the sheath, piercing the synovial membrane, and dividing it to a considerable extent, carrying the cutting edge of the tenotome under the skin and parallel to its surface, so as not to wound either it or the deeper parts. It often happens, that even when the sac has been thus freely divided it will reform and fill again, but counter-irritation hardly ever fails to remove the newly effused fluid pretty quickly, however intractable may have been that first effused. Injection with iodine may be resorted to if desirable, and it never happens, that a dropsy void of melon-seed bodies refuses to yield to such a measure, combined with counter-irritation and pressure.

The distended sacs containing melon-seed bodies cannot get well under mere counter-irritant treatment.[1] Incision of the sac, as above described, is therefore necessary; but it is not always possible to cause evacuation of all these little concretions, and those left behind keep up sufficient irritation to determine the return of the dropsy. When the disease occurs in the large sheath of the flexors of the fingers, it is very difficult of cure. Professor Syme has published the account of such a case,[1] in which he laid open the palm and wrist from end to end, cutting through the palmar fascia and the annular ligament, and took out all the melon-seeds he could find; but the anatomy of the part shows that, even so, he could not get at the whole cavity of the sac, except by turning the superficial and then the deep tendons out of the carpal groove. I have treated such cases less heroically with success; and although I should not venture to say that such an incision was never necessary, yet it certainly need rarely be resorted to.[2]

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[1] Observe the likeness of this disease to hydrarthrosis with change of structure.

Ganglia have been much more the subject of minute inquiry in France than in England, where, if we are to judge from the descriptions given in most surgical works, the utmost discrepancy as to their anatomy and pathology prevails.

Thus Chelius (South's translation, p. 629) describes them as "round, of slow growth, rarely exceeding the size of a pigeon's egg, and in general consisting of thick-walled cavities developed in the neighborhood of joints and sheaths." Miller, p. 546, says, "the cyst is thin and transparent." Cooper (*Dictionary*, art. Ganglion) speaks of "an encysted, circumscribed swelling;" while Syme, *Medico-Chirurgical Transactions*, describes under that name one of those non-encysted tumors which occasionally occur in the palm of the hand and wrist. Again, Chelius especially mentions "little, white, cartilaginous bodies," as a constant part of their contents, while most do not mention such bodies at all.

Where such wide discrepancies in the description of the broad general characteristics of a disease exist, it is certain that the writers are treating of different maladies under one name. The term "ganglion" has acquired a popular sense, and has been applied so broadly, that it has lost the precision of meaning which alone stamps value on a scientific term.

It is necessary, at the very commencement, to deny what many have stated—that such tumors are usually new formations, produced by the establishment, through friction, of a bursa, which gradually increases until it becomes a tumor. It is well known that friction upon the skin will often produce a bursa, but not without thickening of the skin itself, and it is just at the back of the wrist, where these tumors are most frequent that the skin is thinner than in any other part of the hand. Moreover, there exist normally from fifteen to twenty small bursæ about the hand, but not one of these is at the back of the wrist: they are placed chiefly over the prominent heads of bones, in situations where I do not remember ever to have observed a true ganglion or to have seen one described. The fact is, that the membrane, which forms the wall of these tumors, is borrowed from some normal synovial sac in the neighborhood, and it is on account of the great abundance of such tissue about the carpus and tarsus, viz., in sheaths of tendons and multitudinous joints, that such swellings are peculiarly common in these situations. Cruveilhier was perfectly aware of this fact, for he says, in the third volume of his *Anatomie Pathologique* (p. 455), "I shall divide synovial cysts into two categories; *a.* into periarticular; *b.* into peritendinous cysts." Reinhard, a German writer of high eminence and remarkable precision, observes, in the art. Ganglion, of the *Medezinische Chirurgische Encyklopädie,* "It was soon made out that they must belong to the bursæ and synovial sacs of joints and sheaths of tendons." Other writers hold the same opinion with regard, at least, to the synovial sheaths, but it is strange that no English author amongst the many whom I have consulted, mentions their connection with joints, although it is perhaps as common as the tendinous origin.

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[1] "Contributions to the Pathology and Practice of Surgery," p. 212.

[2] See my paper "On Synovial Tumors in the Neighborhood of Joints," Lancet, Oct. 9th, 1858.

The point to be now more especially examined, is the mode whereby such swellings can be formed from a normal synovial membrane. In every such sac, there must exist a certain position of parts, in which the least space is given for its contents, and in which, therefore, such contents press upon the free and reflected portions of the membrane. Thus, if the sac belong to a joint placed in such a position, the fluid will be forced from between the articular surfaces against the free portion of membrane which unites the bones, pressing it with more than usual force against the restraining ligament, until some part of it being weaker than the rest, or being opposite a little mesh or cranny between the fibres of the ligament, becomes stretched and pushed back, either into the subsynovial tissue, or into such a lacuna of the ligament itself. The same thing may, of course, be said, *mutato nomine,* for tendinous sheaths. The joints in which such actions are most likely to take place, are those having large articulating surfaces, and small reflected portions, which act as *diverticula.* When such a knuckle of membrane has, as above described, been pushed out, it withdraws itself more and more, until it forms a cup which constantly secretes and receives fluid from the general cavity, till it becomes distended into a globular excrescence or hernia from the synovial membrane. This protrusion is at first very minute, not so large, perhaps, by half, as the head of a pin, and it may remain always of this size, having still a small communication with the synovial sac, and appearing simply as a little addition thereto. Such appendages have been found connected with various joints, the knee, the shoulder, &c., but above all with the carpus. I have also found them at the astragalo-scaphoid. They have been described as normal structures; M. Gosselin, of the Hôpital Cochin in Paris, draws particular attention to them, and giving them the long name of synoviparous crypts, describes them as destined to increase the amount of secreting surface, and as occurring not only in man, but in animals also. He went to the abattoirs of Paris, and there examined the carpal and tarsal joints of a good many horses, and found synoviparous crypts in them. Yet, in spite of all this evidence, I do not believe that the normal condition is the existence of these sacs; because the physiological reason given for their presence is inadequate. Let us consider, for instance, the synovial membrane of the carpal joints, which is so extensive, that it lubricates not only the joint between the two carpal rows, but the junction between each pair of bones, and the four inner carpo-metacarpal articulations as well. I say when we consider the size of this membrane, and the extent of its secretory surface, we shall not readily believe that it can be materially assisted by five or six follicles not so big as pins' heads. Then, again, I have examined many carpal joints, and must acknowledge that, if we take our subjects from the dissecting-room or hospital dead-house, we shall in all probability find synoviparous crypts. Such persons are usually somewhat beyond middle age, and have led hard-working lives, but if we take our example from the hands of children, no such structures will be found. The hands of ladies who have in their lives done nothing severer than worsted work come seldom under examination, but in one that I had the opportunity of dissecting, I found no synoviparous crypts, although I studied the whole membrane with a glass. Again, there is a class of women whose mode of life and poverty combined often bring them to the hospital, although their hands are free from the signs of labor: in these synoviparous follicles are absent. Lastly, they are more common on the right hand than on the left. Indeed, we may take the condition of the skin of the hand to represent the probability or improbability of there being any such excrescences; therefore they are, I believe, abnormal, the result of hard work and straining of the joints, and they occur in the place where we should expect such results to appear; namely, chiefly at the carpus, where the whole secreting surface is very large, and where the portions reflected from one bone to another (which act as diverticula) are small. Moreover, when, from certain positions of the joint, the fluid becomes forced into that space, and presses against the synovial membrane, it must take most effect upon that portion of membrane, which is least supported by ligament; and this is just at the angle of reflection, where the membrane leaves the bone. It is at that spot, therefore, that we should expect to find most frequently the results of over-exertion, and it is here that we really do most frequently find synoviparous crypts. As for the animals which M. Gosselin examined, it must be remembered that they were omnibus and fiacre horses, which, after a life of severe labor, had been condemned by the knacker, and, therefore, creatures on whose joints we should expect to find the results of over-work, as M. Legouest has observed.

The little processes, then, which are found projecting from synovial membranes are not physiological, but pathological formations, produced by a pressure from within, as previously described. They are at first almost microscopic, and may be seen by examining the inner surface of the membrane, on which (causing it to protrude) they create a slight pit, generally with an orifice in its centre. One of these excrescences, which shall have passed into a mesh of the capsule, may increase considerably until it protrudes through the fibrous structure, forming a tumor on its outer surface. The channel of communication with the original sac may still remain open, or it may have closed, leaving only an imperforate cord passing through the ligament, and connecting the cyst with the synovial membrane; or, lastly, even this cord may have disappeared, so that all means of tracing the origin of the cyst are lost, and it appears like a new formation. In a hand which I dissected during the winter of 1857, I found on the first phalanx of the ring-finger an oval tumor, not so large as a horse-bean, the long axis of which corresponded to that of the finger. It was of an amber color, and adherent by a small point to the fibrous sheath. I removed the sheath with, of course, its lining of synovial membrane, and found on looking at its inner side, a small opening, through which a bristle could be passed, whereby it was shown to communicate with the interior of the tumor. I endeavored to preserve these parts in spirit, but the semi-fluid contents of the cyst were soon dissolved; in endeavoring to pass a bristle through the narrow opening to act as a spring in the tumor and distend its walls, I unfortunately used a little too much force, and broke it away. This hand had belonged to a coachman, and bore many signs of rough work. The palmar fascia was in one part scarred and contracted into a thickened cord, which prevented straightening of the middle finger; and there were three synoviparous follicles at the base of the os magnum. In hands of this sort, cysts as above described are not very rare. I have seen one on the sheath common to the extensor ossis metacarpi and extensor secundi internodii pollicis. This was bilobular, and extremely tense; the peduncle connecting it to the above-named sheath was very thin and imperforate. I have also seen one at the back of the carpal bones, connected by a stalk to the joint between the scaphoid, semilunar, and os magnum. I have seen one lying unconnected at this spot. In fact any one, who carefully examines a number of hands, will be sure to find such tumors in different stages of progress, from the first simple bulging of the synovial membrane, to the cyst lying free amongst the tendons and upon the ligaments, which increases like other cysts by virtue of its own secretion, whilst its walls become thickened by a fibrous layer, either derived from the structures through which the tumor has passed, or acquired by the constant friction to which its prominence exposes it, until the cyst becomes round, hard, and elastic, rather than fluctuating.

Ganglia may occasionally be cured by counter-irritation, iodine, or other such application, but in by far the greater number of instances, they will not yield to such treatment, and something more decided must be done. There is generally, in these cases, an amount of vague fear as to the effects of any treatment, which arises, I believe, from the evil result produced in a few cases in which the sac of the ganglion still communicated with a joint, and as this condition has not generally been understood, it is evident that certain cases would, energetically treated, end disastrously. It is highly important to ascertain the true condition of the cyst, because we may use, upon an independent one, treatment that we dare not apply to one still in connection with a joint cavity. The mode of making this distinction is by pressing on the cyst, and observing whether it becomes slowly reduced, and whether, when this pressure be removed, it will as slowly reappear; if so, the reduction is of course due to the passage of fluid into the normal synovial cavity; if, as sometimes happens, the tumor vanish suddenly, and return as quickly on the application and suspension of pressure, this reduction is *en masse;* the whole cyst has slipped under a ligament or some other fibrous structure in the neighborhood; the greater number of these swellings are not in any way altered by pressure.

If by these means the entire independence of the cyst have been established, some mode may be adopted to produce its evacuation, and the subsequent absorption of its walls. The old plan of striking it forcibly with the back of a book or other hard object is barbarous in the extreme, and I have known it productive of evil consequences; the same may be said of rupturing the cyst by pressure with the thumbs. I have frequently emptied the cysts by a subcutaneous section with a small tenotomy knife, dividing their walls freely from side to side (occasionally I believe I have cut them quite in half), and then applying a splint with considerable pressure over the part. The following is a good mode of using a pad or splint, so as to obtain the greatest amount of pressure. A strap is fastened by brackets to the splint, allowing a certain amount of movement up and down; the strap carries a metal plate with screw holes, and a screw presses upon a pad placed over the ganglion. Undue pressure upon the rest of the wrist is prevented by the breadth of the splint and thickness of the pad, which does not allow the strap to touch the skin anywhere, being lifted away by the screw.

Sometimes even this is not sufficient, and then such a cyst may be injected without fear. Tincture of iodine and water, one part of the former to three of the latter, appears to me the very best possible injection; in using it, we should endeavor to empty again through the canula the same quantity, as nearly as possible, as was injected, but such manipulation and pressure are to be avoided.

CHAPTER XVI.

ON HYSTERIC PSEUDO-DISEASE OF THE JOINTS.

PATHOLOGY.

AMONG diseases whose pathology is most difficult, hysteria takes a high place, not only because of its multifarious manifestations, but also because they occur under such widely different circumstances. There is anomaly in its very name; for it occasionally presents itself in the male sex. And this misnomer is not one of words merely, for I believe it frequently occurs in women without owing its origin in any way to the uterus or other organs of sex. It is well to consider this latter proposition most carefully, for certainly much harm is constantly done by determinedly referring all so-called hysterical symptoms to an irritability of the generative system, and in ignoring other circumstances and conditions which would be at once perceived and whose influence would be immediately acknowledged if this fixed idea did not too much occupy our thoughts. Now hysteria may appear under a great variety of forms; and, as is well known, has a very strong tendency to imitate a vast number of diseases; but for our present purpose, and indeed for its whole pathology, it will suffice to divide it into two classes: firstly, Hysteric Paroxysm; secondly, Mock Disease; and to observe the circumstances under which these usually occur.

The Hysteric Paroxysm or fit is apt to come on under any condition, whether there be present or not any traceable uterine disturbance, such as amenorrhœa, dysmenorrhœa, &c. An emotional woman may at any time be liable to such paroxysm; but it is certainly more common in those whose uterine functions are badly performed, or in whom any temporary irritation exists; for instance, many women who ordinarily are in no wise hysterical always suffer from tendency to such attacks when with child. Again, prostitutes are peculiarly liable to the hysteric fit. In these instances a generative irritation is easily traceable; but such paroxysms occur to persons in whom no such cause can be found; this is hardly a case in which the dogma "*de non apparente et de non existente eadem est ratio*" will hold, although, practically, we must assume it. We never can look so closely into the life of man or woman as to assert that no outward cause of disappointment or excitement may not have its influence.

The slower and more obstinate form of hysteria, which assumes the shape of some other disease, is, I believe as a rule, unconnected with any traceable disturbance of the uterine functions. A great number of such cases have come under my notice, and comparatively few of the patients have had any such disorder. It is rare that both manifestations of hysteria, viz., the paroxysm and pseudo-disease, are coexistent; patients who suffer from the one do not as a rule suffer simultaneously from the other; but it is not unfrequent, that when the fits disappear a mock malady comes on the scene, and this latter is sometimes dispelled by a violent paroxysm.

All practitioners frequently meet with diseases which they know to be more or less imaginary; if they occur in a man we call them hypochondriacal, but if in a woman hysterical; although all the symptoms may be precisely similar. Hypochondriasis is hardly observed in men who lead active, hard-working lives, and we ascribe the condition to a state of imagination brought on by too little occupation for the bodily strength or for the thoughts. If we compare, in regard to activity, the lives of women with those of men, we should be led, putting all physical differences of sex aside, to consider that these latter less active class would be more subject to the hypochondriacal condition; when we add to this comparison the more emotional and imaginative character of the woman, their proneness to the disease would be heightened without the necessity of including mere sexual formation. Hence, for the Mock-Disease of Hysteria, experience as well as theory leads us to conclude that disturbance of the generative functions plays a less active part than is usually ascribed to them.

Against these considerations may be brought the fact, that women, subject to this malady, so frequently get well upon marriage; but it is not right to fix upon the change in bodily condition, thereby produced, as the cause and sole cause of this recovery. A girl on marrying acquires duties, cares, and interests which then fully occupy her mind, more particularly while they have the charm of novelty. In many instances a person will be cured of this hysteric condition during the first period of marriage life, but fall into it again when the novelty of being mistress of a household has worn off, and has ceased healthfully to amuse and attract her thoughts.

Thus when we come across any case of such hysterical joint-disease, it behooves us to consider the actual character of the malady presented to us; by a woman perhaps in all other respects perfectly healthy. It is, I conceive, hardly right to suppose that these patients wilfully deceive their nearest relations, their medical attendant, and all with whom they come in contact: but at the same time we cannot for a moment imagine that any local disease is present. It seems that the malady is centric, not eccentric: that the mental condition, which first conjured up in her mind the idea of local pain, may have originated in an irritation reflected from the sexual organs to the nervous system, or may have simply been caused by want of occupation and hypochondriacism. The patient, however, believes her sufferings real, although she feels that she can call them forth or repress them by her own feelings and imaginings, until at last pleased at exercising this indirect power, and at exciting the pity or exacting the attention of relations and friends, she comes, in the latter stages of the disease, to delight in alarming and tyrannizing over all her surroundings by means of her false pain and invalidism. Every one has met with pitiable instances of wives establishing over husbands a reign of terror, or of daughters reducing over-fond mothers to slavery. In the worst of these cases the patient's condition would be more easily shown to be insanity than sanity, and in some a degree of mixed cunning and cruelty exists which are very like the symptoms in certain forms of mental aberration.

SYMPTOMS.

The joint affection, the mere local manifestation of the malady, is of no importance except so far as it is of moment to distinguish it from a real disease; a mistake either way may lead to disastrous results.

In the first place it is necessary to disabuse our mind entirely of the idea that a uterine irritation or functional disorder lies of necessity at the root of this evil, but it is our duty to distinguish between the cases thus connected and those having no such cause. In some instances the menstrual function is more or less disordered; in some the patient has been in the habit of having hysterical paroxysms and globus hystericus, which ceased before the pseudo-disease came on. In other instances there never has been any derangement of those functions nor any suffering that can be traced to uterine derangement. In the first, we recognize a case truly hysterical; in the third, one entirely mental, or hypochondriacal; in the second, one wherein the uterine origin of the disease may still be active, and may keep up the condition of nerves whereon the malady depends.

In an affection confessedly so variable as this, it would be futile to endeavor to give any account of all the symptoms to be observed in a large number of cases; but two peculiarities may be fixed upon as especially characteristic of the hysteric joint: these are anomaly, and the absence of the ordinary signs of inflammation. In estimating the former it is essential that the surgeon be perfectly acquainted, not only theoretically but practically, with all the symptoms of the various sorts of joint-disease, otherwise this characteristic will escape or only puzzle him. With regard to the latter we will shortly examine which of the four signs of inflammation, viz., pain, heat, redness, swelling, are, by their absence, most influential in establishing the diagnosis. The first is to the patient a subjective symptom; it is one which does not present itself in any way to the senses of the surgeon, and he has to take the affirmation of the sufferer in regard to it more or less upon trust, and it is in this very symptom therefore that he chiefly finds the statements of an hysterical patient varying with actual fact, it is in this peculiarity that anomaly is chiefly betrayed.

Heat is an important symptom when it occurs in real joint-disease, but it is not always present; its absence, therefore, becomes less important in the pseudo-malady. A surgeon when he first sees his patient will frequently find the affected joint wrapped in flannel, irritated by stimulating liniments, perhaps blistered, or even the seat of suppurating issues; all these add very much to the difficulty of the diagnosis, and if the last conditions be present he had better defer giving a decided opinion until the normal state of parts has been restored. In cases not thus complicated, a few minutes' pause after uncovering the part while the patient is engaged in conversation will allow the limb to return to its natural temperature if merely heated by flannel or other wraps. An hysteric joint is not hotter than the opposite unaffected one: indeed it has often appeared that it gives a sensation of greater coolness. I am unable to give any thermometrical proofs of this fact, nor do I believe greatly in their value when applied to mere surface manifestations of heat and cold. For there certainly are many surface conditions of all bodies, which, without affecting a thermometer, give a very different idea of heat or coldness to the hand: some such condition is always present in inflammatory joint-disease, and always absent (unless it have been artificially produced) in hysterical mock-disease.

Redness is, as we know, frequently altogether absent in real joint-maladies, particularly if the inflammation be in a deep joint, and if it be of the strumous character; its presence or absence, therefore, is of little avail in determining the true or false character of any particular case; but it is right to mention, that in certain instances of the hysteric disease there is frequently a capricious and transient blush upon the surface, pinker in color, and evidently more superficial than the dull hue which, when redness accompanies real joint-disease, appears to lie deep beneath the skin.

The fourth inflammatory symptom, *swelling*, is one which may have been produced by mistaken irritation. An hysteric joint is not swollen (unless artificially); there may be a slight puffiness, or œdematous enlargement on the surface (subcutaneous), but this is a very different thing to the appearance of effusion into the joint or deep-seated thickening; it may more resemble inflammation of parts external to joints; but then, many symptoms related in the foregoing chapter, namely, circumscribed swelling and tenderness in the known situation of a bursa or tendinous sheath, are absent.

We will now examine the different forms of anomaly, the mode of detecting it, and its value in different joints; only premising that we have already discovered an important one, namely, the presence of pain in or about a joint without any other clear symptom of inflammation; there may be an attempt as it were to imitate these latter, but on examination they are all found to fail: let us see if pain can hold its place against a careful investigation.

The articulations most liable to be affected by this malady are the hip and the knee; other joints are occasionally attacked, but more rarely, and the reader may easily transfer the account of the diagnosis in one of the two instances to be described to a case of suspicious disease in another joint. Hip-joint disease produces, as we know, in its second stage certain deformities dependent in part upon actual organic alteration; in part upon a peculiar contraction of the abductor muscles produced by the local irritation. It is partly in the mode of placing the limb that we shall find variations from the usual methods in joint-disease which may first of all render the case suspicious. On examining the patient, who generally will be found in bed, we shall first observe that the pain complained of is tolerably diffuse over the whole buttock of that side; it is probable that pain in the groin will not be mentioned (commonly absent at the beginning of hip-joint disease), but if it be so it will be also somewhat diffused, and has considerable tendency to locate itself above rather than below Poupart's ligament. Moreover, tenderness is, as Sir B. Brodie has observed, "very severe upon the slightest pressure or even contact;" indeed, the patient shrinks almost before she is touched, and if the surgeon magnify his commiseration for this pain and his fear of increasing it—if he suggest pain as being present in different parts—he will cause the patient to confess it anywhere. Thus it is very important that an attendant, seeing for the first time a young woman with a suspicious joint-malady (particularly hip or knee), should not put such leading questions as shall enable her to shape her answers accordingly, and thus to make up a good history of real disease; rather, he should endeavor to put the question so as either to leave her entirely to her own resources for a reply, or so as to suggest to her an answer manifestly incongruous. Any one having to do with cases which have been already through a good many hands finds again and again that the pristine imaginings have been improved upon under the lengthened tuition; in an unsophisticated case, this pain and excessive tenderness will not be confined to a spot behind the trochanter, and it will be so acute that the patient cries out as much or more when the skin merely is touched, than when a firmer and deeper pressure is made. Moreover, if the patient's attention can be engaged while the examination is going on, by conversation or other means, the parts previously tender can be manipulated without producing signs of pain. The sort of pain complained of is more like that of a neuralgia than of joint inflammation, but it does not run in the course of the nerves; it is frequently said to keep the patient awake, but it does not wake her; it very rarely happens, if ever, that pain simultaneously affects the knee, and pressing or knocking upon the sole of the foot does not produce any pain at the hip.

It has been shown (Chapter XIV.) that the changes in length of the limb are due, in real hip-disease, to position. The usual course is that at first an apparent lengthening occurs which is soon followed by shortening, and there is always a certain though an indefinable proportion between these alterations and the intensity of the inflammatory symptoms. In the hysteric pseudo-disease shortening is nearly always the first change, and this is disproportionally great in regard to any inflammatory symptom; and what renders this condition still more valuable as a means of diagnosis is its variability. To estimate these appearances fully it is necessary that the patient be made to stand up; the surgeon seated behind her will observe that the pelvis on the side of the pain is tilted up and drawn backwards in the same way as in true hip-disease; but the spine is much more twisted, the nates on that side are protuberant and the muscles tense. Let the patient remain standing some considerable time, and be engaged in answering questions having no especial reference to the place of the disease nor to the pain, and the forced position becomes less and less marked until it is nearly natural. But a remark directed to the hip, or a hand laid upon it, will instantly bring about a resumption of the mal-posture. Again, whether the patient have assumed one or the other position (lengthening or shortening), the swelling cannot be imitated. We have previously called attention to the obliteration of the fossa behind the trochanter, and to the deep swelling in the groin below Poupart's ligament (p. 300). One or both of these are always present in real disease when deformity sets in. They are the only points[1] in form and outline which cannot be imitated by hysteria. If to these signs be added the absence of that expression of suffering and anxiety which is always more or less frequently strongly marked in coxitis, the surgeon will have no difficulty in detecting the true nature of the case. Patients affected with hysteric hip-disease have nearly always a healthy appearance, sufficient embonpoint, and good appetite.

In an imitation of knee-joint disease the pain complained of will often be very severe; disproportionally so to the amount of local disturbance which at first glance appears; it may keep, or be said to keep the patient awake at night, but it never wakes her when she is once asleep. The limb will generally, while under observation, be held perfectly still and semiflexed in the same position as is taken in real disease, or the patient may still walk, but with limping, and signs of suffering; the pain is referred to a spot on each side the *ligamentum patellæ,* and is increased on the slightest touch, particularly if a piece of the fatty cushion there situated be gently pinched between the finger and thumb. Such mode of manipulation, indeed, appears to cause more pain than a pressure exerted by the broad surface of two or three juxtaposed fingers, and gradually increased so as to influence the deep parts. There is seldom pain or tenderness above the patella, and if this bone, grasped at its upper part, be moved backward and forward between the femoral condyles no tenderness is complained of. In those cases, in which the joint is kept rigidly semiflexed, the surgeon should endeavor with slight force to straighten the limb, keeping his hand at the time upon the ham-string muscles. He will then feel these act strongly with active contraction, which will communicate to his hand a sensation utterly different to the passive retraction of muscles which follows a long-standing disease of the joint. In a case of doubt chloroform is a most useful aid to diagnosis, which fact I believe myself to have been the first to point out, in a paper read before the Medical Society in 1858. Under its influence perfect mobility, as of an entirely healthy joint, will be restored. The above signs, with absence of any swelling or thickening of the deep parts, and of the other inflammatory symptoms, as already mentioned, will fully suffice for diagnosis, particularly if measurement show no enlargement of the joint.

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[1] Except in the late events of hip-disease.

There is a point which I have known to mislead in diagnosis, viz., a certain crepitation in the joint complained of. Now, many boys, as well as girls, arrived at puberty, or at the period of rapid growth, are subject to a peculiar crackling at the joints, chiefly the knee, hip, and maxillary articulation. This is quite painless under healthy circumstances, and children frequently amuse themselves with the odd sensation it produces. But if the individual be a girl, who, verging into puberty, becomes weaker with chlorotic tendency, this crackling is very apt to continue in one of the joints, and at last to become the secondary cause of a neuropathy fixing itself in a certain part, and gradually assuming the character of an hysteric joint. Thus, then, we may find in such a malady a certain amount of crackling, comparable to rubbing together two surfaces of parchment, of coarse silk, or of crape, and which is not like any of the crepitations in joint disease, except an early stage of hydrarthrosis.

Occasionally, though rarely, hysteric pseudo-disease of a joint goes so far that a sort of imitation of "starting of the limb" comes on, of which in some cases the patient complains, as causing great pain, and which in others is perfectly painless. No surgeon will for a moment mistake this phenomenon for the starting pain whereof so frequent mention has been made in previous chapters; but the differences are worth recording, if merely for their curious physiological character when regarded in connection with the true symptom. In most cases the hysteric movements only come on when some one is present, though the patient may affirm them to be constant, which they rarely are. They are rhythmical, sometimes recurring with immense rapidity, sometimes synchronous with the pulse. But the circumstance most worthy of note is that they cease during sleep, even before consciousness is altogether lost, and they do not return until the patient is fully awake in the morning. Now, the starting of the limb from articular inflammation is always worst just as the patient sinks to sleep, when the controlling power of the will is withdrawn. This difference in the time of occurrence marks their several origins—the one is dependent upon the cerebrum, the other, independent, even requires the withdrawal of its power.

TREATMENT.

This malady has attained an evil notoriety, as the *bête noire* of medical practice, and nothing can be more fatiguing than the constant iteration of incongruous pains, the unvaried ringing of monotonous changes concerning this sensation and the other, which certain patients insist on forcing upon us. The weariness which the subject creates may have led us too much to pass over hysteria as a malady connected with some ill-defined, often undiscoverable uterine disorder, and to order at once some set prescription of tonics and emmenagogues. But if, as we have seen, there be two conditions in which a mock-disease may occur, we ought to distinguish one from the other in our mode of treatment; even the form which appears to have begun in a uterine affection, but in which no detectable disturbance of that organ remains, must not be treated as though such condition existed. The so-called hysterical joint disease frequently presents itself in the persons of strong florid girls, troubled with no menstrual disorder or leucorrhœal condition, and I am sure that cases have presented themselves to me in which the administration of iron, aloes, and other such medicines has been injurious. When, on the contrary, any such disturbance is present, it is to be subjected to the recognized methods of treating the particular form of the complaint. In most cases the best physical management is a combination of such hygienic measures as exercise, cold baths in the morning, a non-stimulating diet, &c.

The most important part of the management is, however, rather mental than bodily, and depends upon the amount of control which the surgeon can exercise over his patients. Having ascertained securely his diagnosis, he must enforce obedience to his ordinances, whatever they may be. Great caution and power of judging character are necessary, that he may insure faith; and considerable firmness, to insist upon the performance of anything he may command, for if the patient once overcome him he will scarcely ever regain control. In some cases, even when the patient has been in bed for weeks, perhaps months, one can make her get up and walk about on the first time of seeing her; in others, one may have to be a little less peremptory, though equally determined. If the person be possessed of good sense, and of a real desire to recover, it may be well to explain the absence of all organic disease, and the necessity of exerting her own will in order to recover. At the same time, in all cases, relatives, or other surroundings, must be cautioned against yielding to any signs of invalidism, or any attempt at lying by, and being nursed and petted.

Sometimes we may endeavor to interest the patient's imagination, and draw it away from the spot whereon it has fixed. For this purpose I have, in some instances, made use of an expedient which, I believe, will often be found useful in cases where the patient's confidence rests fully in the attendant, and some real desire to recover exists. The value of the plan lies in calling the person's mind away from the affected spot of the body, and establishing a firm belief that when a certain event takes place the pain will cease. I have used a seton of a single silk thread, passed through a small fold of skin, at some considerable distance from the seat of pain, and have endeavored to make her firmly believe that when the silk comes away the pain will leave her. Such a method of practice is nearly sure to be successful, since it is applying directly to the mental function really affected, and it is such as is often injuriously employed by miracle-mongers, clairvoyists, and others, who take a dishonest hold of the credulous imagination of their victims, and make them the instrument of jugglery and deceit. The difficulty, however, in our treatment is to create a sufficiently firm belief in anything so plain and simple as to look like truth, and as not to excite the love of the marvellous, nearly always a large part of the hypochondriac condition of mind. When, therefore, that method fails, it does so, I believe, because we have not been able to produce sufficiently strong credence in its efficacy. The rapping of a spirit or the winking of a statue might have proved more efficacious. But let it be understood that I advocate no deceit. The patient may, in general, be told that the disease is not really in the joint, but in the nerves; and there is no deception in fixing the patient's belief on a certain event as a cure, because if she really can believe it she will be cured at the occurrence of the event.

It is to be feared, however, that many cases of hysteria are obstinately incurable by what are called medical means; it frequently happens that when the patient has left us well and free from all such disorder, she will come back after months, or even after years, with other symptoms of the same disease. Such will occasionally happen, although all the circumstances of life may have been changed in the interval. The patient, formerly a green-sick girl, will return an established matron, with three or four children, but affected with another manifestation of the disease; and I have great reasons for believing, that persons who in their youth have been subject to hysterical manifestations, may, though in middle life free from them, again suffer about the 45th or 50th year. Medical treatment, in the strict meaning of the term, appears of little avail, except temporarily, when there is uterine disturbance. Physical and mental hygiene, strong reason, good sense, and a sound dislike to invalidism, is the only cure. Cold baths on rising in the morning, exercise, pure air, and cheerful amusements, are the true methods of combating the morbid state.

It should be particularly observed that any application to the part itself is injurious, as tending still more to fix the patient's attention upon that locality. Leeches and blisters have often done almost irreparable injury.

CASES OF THIS DISEASE.

CASE LVI.—Jane Goldwin, aged 19, a fine well-grown girl, came into the Charing-Cross Hospital, April 22d, 1856, under the care of Mr. Hancock, for disease affecting the right knee, which had come on about three months previously. The joint was held semiflexed. She complained a good deal when the knee was touched, or when the surgeon attempted to flex it, or to straighten it. She usually kept it wrapped in flannel, but when this had been removed some time it was not hot.

The joint was not altered in form, except that the ligamentum patellæ was perhaps a little obscured from superficial swelling on each side of it; it was in this place that both pain and tenderness were most severe; the former, she said, kept her awake, but she confessed that it did not awake her when once asleep. Measurement of the knee showed it to be a little larger, both above and below the patella, than the other. This difference varied slightly during the progress of the case, but was always less than one-eighth of an inch below, and never amounted to a quarter of an inch above the knee-pan.

The joint has been blistered, &c. The whole case is suspicious. Menstruation is perfectly regular and natural, there is no leucorrhœa, she never had an hysteric fit in her life, nor could any confession be obtained of a feeling like *globus hystericus;* these circumstances, and the perfect rigidity of the joint, rendered the diagnosis a little difficult. Chloroform, therefore, was administered, and when she was under its influence the joint became perfectly mobile, without crepitus, or any morbid condition whatever.

It is useless to follow out the various medicines administered, the several plans tried, and their failure. The girl seemed to suffer more, and was constantly begging that the knee might be taken out, an operation of which she had apparently heard. Accordingly, on the 17th May, she was taken into the operating theatre, chloroform was administered, and Mr. Hancock made a long incision on either side of the knee-joint through the skin; these were then dressed, a splint was applied, and she was taken to bed again.

May 19th. She says she has had no pain, except tingling in the wound, since the operation. She was informed that it had not been found necessary to take out the knee-joint, and that when the wounds healed she would be quite well.

June 17th. There has been nothing further to record than gradual healing of the wound without return of the old pain. She has been of late walking about the ward perfectly well, and to-day she walked away cured.

CASE LVII.—M. C., unmarried, aged 28, a pale and rather anxious-looking girl, came to me, 21st August, 1858, on account of a slight bursal inflammation and swelling over the right patella, which was treated and cured in about ten days; but in a week after she presented herself again, complaining of pain in the other knee, just under the patella, and on each side of its ligament. The knee was quite cool. When the foot was pressed even forcibly upwards, nor when the patella was moved from side to side, if only the place to which the pain was referred were not touched, no expression of pain could be elicited. The joint was in every dimension the size of the other. The menstruation was regular but small in quantity; she had considerable leucorrhœa in the intervals; had *globus hystericus.* It was very perceptible that the tenderness was increased and spread over a larger surface, and that she flinched more at the monthly periods; she also confessed that she suffered more from the knee at those times. Quinine and iron, with some valerian, was given thrice in the day; iron and aloes evening and morning with the effect of diminishing the leucorrhœa and increasing the menstruation.

October 10th. The general health had now considerably improved; but finding that the knee did not get better, I determined to try a means of making the patient's faith in a more visible treatment than internal remedies operate a cure. She was, therefore, told that blisters or other application to the knee would only do harm, but what was wanted was to draw the pain to another part, but that we must be sure to choose a time when her health was well enough to bear it. This latter phrase was added only to excite her curiosity about the remedy, of whose nature she was not told. It was contrived that for a time something should prevent this application until she begged earnestly for it herself, and then she was informed that it was the passing a piece of silk through a part of the leg, and that as it gradually worked out she would be freed of her pain. A suture was then prepared, and considerable show of great care in the choice of the proper place was displayed, and then the small single thread seton passed through a fold of skin at the inner side of the calf. Minute directions were given about the way of dressing the little punctures, and the necessity of watching it. She came back very often to tell me of the progress of the seton, and said the knee was certainly getting better; and at last, when the silk had come out, came to thank me, saying the knee was quite painless.

Case LVIII.—Sept. 1858. Miss Mary L——, aged 18, strong and rosy, was removed two months ago from school, being supposed to have hip-joint disease.

The girl's aspect is from the very first suspicious, being much too hearty for such a malady. She was lying on a couch quite dressed, and I sent her up stairs to bed, that I might fairly examine her. While lying prone she keeps the left thigh a little bent, so as to raise that knee from the bed; the spine, at the same time, is crooked. Severe pain is complained of all over the thigh, hip, buttock, and side, even to near the scapula. The tenderness was not at first so extensive as after prolonged examination. Made her stand up, I seated behind her, found the left side of the pelvis raised, the fossa behind the trochanter not at all obliterated, the knee in front of the other, and somewhat inverted. The position simulated hip-joint disease sufficiently closely, but the absence of all swelling was remarkable. On keeping her standing some time the position became less and less marked.

The menstrual functions are quite normal, nor does there seem any sign of bodily disease. I insisted upon her walking half a dozen times up and down without a stick. At first I took hold of her hand, and partly helped, partly forced, her to walk; afterwards made her go by herself, which she did at last, with hardly any limp, but half crying the while.

She had been put upon a strong diet, and was taking steel. I prescribed a less stimulating food; no wine; meat only once a day; cold bath in the morning; a little walking every day. Explained to the young lady's mother the nature of the case and necessity of her using all her influence in preventing her daughter lying up, and recommended some interesting pursuit.

A great many battles had to be fought with this patient. Sometimes she would declare she could not get off the bed; but on one of these occasions she was left unattended to till she found herself capable of moving. At last, when she obstinately refused to put foot to the ground, and the point was insisted upon by both her mother and myself, she had a regular hysteric paroxysm, and from that moment the case was more easy of management. She got well about four months after I first saw her.

CHAPTER XVII.

ON THE RESTORATION OF MOBILITY AND CONFORMITY TO CRIPPLED JOINTS.

In the large majority of the inflammatory diseases which we have examined, the natural tendency is to obliterate the joint by a growth of granulations, *both inside and outside its cavity.* When those in the former situation organize further and form fibrous tissue, false anchylosis is produced; when the structure becomes ossified, the anchylosis is called true. The fibrification of the granulations on the outside of the synovial membrane is also accompanied by the same mode of contraction which takes place in all cicatrices; hence, the parts in which those structures have been produced tend to become *contractured.* It frequently happens that the disease will have begun to heal before the cavity of the joint has been much encroached upon, hence, anchylosis does not take place, but contracture may follow; on the other hand, obliteration of the joint cavity can hardly occur unless accompanied by much tissue-production around the synovial membrane; thus, though a contracture need not be combined with an anchylosis, this latter is nearly always accompanied by the former.

Throughout our indications for the treatment of inflammatory joint-diseases, we have strongly insisted upon the necessity of certain positions to be preserved throughout the active condition; it happens that the posture which is most conducive to the cure of inflammation is also that which is most convenient to the patient should unfortunate circumstances produce true anchylosis. But this is not all; we have found in the chapter on strumous synovitis and in that on strumous osteitis, that inflammation having yielded, the process of consolidation very gradually sets in. Thus, the state of anchylosis is bounded by no very distinct line, and we may take up the present subject at the point where, inflammatory action having ceased, the consolidating granulations are gradually causing contracture with or without actual obliteration of the joint. At p. 153 we saw that even when a great deal of granulation had been produced we might, by the use of shampooing, passive motion, and other judicious means, secure the reabsorption of a large part of these formations, the more rapid and complete organization of the rest. Whether this fibrating part be much or little, whether it be situated partly inside or almost entirely outside the joint, it is most decidedly our duty to prevent its contracture into such form and shape as to produce distortion; or to interfere more than to a certain unavoidable degree with the movements of the articulation. Unfortunately there has been engendered in the surgical mind a great dread of allowing any movement in a strumous joint,[1] whether any inflammation remain or no, until the cavity is obliterated. The attendant, indeed, as soon as a scrofulous joint-disease has been diagnosed, only looks forward to that which is called (by courtesy) a cure by anchylosis. The consequences of such treatment are by no means satisfactory, and it is fortunate that the same plan is not followed in other diseases. For instance, a surgeon, having treated and subdued an acute inflammation of a joint, insists upon the performance of movements; if they be painful in the active form he institutes passive motion, and the result is that an acute, non-suppurative synovitis very rarely produces an inconvenient amount of anchylosis or contracture. But when in a chronic synovitis the inflammation has been overcome, the surgeon still keeps the limb immovable, and the result is that such a malady, even when non-suppurative, rarely gets well but by producing an inconvenient amount of stiffness and deformity. If, after a fracture, implicating a joint, had united, the attendant were to defer passive motion until the limb were fixed, just complaint might be made; if (to take an example from a subject not yet broached) a surgeon were to excise the elbow-joint and to neglect passive motion until the new tissue between the bones had consolidated, the judiciousness of the after-treatment might well be doubted. Yet in strumous synovial disease, all inflammation having ceased, my recommendation that passive motion might be used is often met by the question, "Had we not better wait till the tissues are consolidated?" What a strange query that is! Wait till the joint is all but immovable before we try to establish mobility! Wait till the house is burnt down before we attempt to extinguish the fire!

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[1] The strumous inflammation is so much more frequently a cause of anchylosis and deformity than any other, that it is here especially mentioned.

I have no hesitation in affirming that in every case of strumous synovitis, when all signs of inflammation have ceased,[1] an amount of mobility and a general conformity of joint can be gained, which fits it for the ordinary uses of the part, though not for any violent exertion or very active exercise. This is not written for the sake of making a startling proposition careless of its truth; but it is a fact taught me by careful observation and experience, extending over a number of years, and the more I see of such cases the more am I convinced of the soundness of that statement. There are very few examples indeed of strumous synovitis which pass immediately from the inflammatory to the degenerative stage: and not many instances of strumous osteitis occur (if the effects of pressure be prevented) in which such an instant transition takes place. If the joint be kept immovable during the passive period, a very long time must elapse before a cure with a considerable amount of deformity and stiffness will follow, or before degeneration becomes so rapid that removal of the part will afford the only chance of life.

The treatment which prevents either of these contingencies, and establishes mobility of the joint, is passive movement, with shampooing and pressure; and when some amount of mobility and power is restored, active movement with proper support. I have, during only the last eight months, treated one case of strumous synovitis of the elbow and three of the knee; two of the latter fell under my care while in the passive stage; one when some degeneration and suppuration had already begun in certain parts of the sluggish granulation. In all of them the above means restored, after a time (the last case being the most difficult and protracted), mobility to a certain extent. When this change was pretty firmly established I employed a splint, as described below, and permitted the patients to walk with first two crutches, then with one and a stick; subsequently with two, and lastly with only one stick,[2] encouraging them to put the foot properly on the ground, beginning with the heel and lifting the toe at last away. As in each of these cases the knee was somewhat bent, I applied a splint in front of the limb, consisting of a thigh-piece and a leg-piece of wire gauze, connected together at an interval by a flat band of strong steel. The connecting steel portions were thus disposed: they were placed along the lower end of the thigh and the upper end of the leg-piece, and projecting beyond their edges, were riveted together so as to form a hinge at the outside and inside of the joint, in the situation of the respective lateral ligaments. The splint in itself gives no support to the articulation; but two double hooks of an S shape are inserted into meshes of the gauze on the upper and lower portions, at such distance apart that an India-rubber accumulator can be suspended between them at a degree of tension, which may be increased or decreased as circumstances shall require by moving one of the hooks into another mesh of the gauze. The power of the India-rubber forces the joint into a straighter position, gives sufficient support, and yet allows an amount of healthy movement, and therefore gradual re-establishment of muscular strength. No bad effects have followed its use: it is only necessary that the hinge be made of steel sufficiently strong to prevent the India-rubber drawing the two portions of the splint together, and so forcing the bones to press abnormally one against the other. When the apparatus has been worn some time, I adapt to the leg a pulley and rope, whereby the patient can flex the limb passively against the power of the India-rubber springs; by pulling upon the line and then relaxing it, action of alternate extension and flexion can be produced. A further notice of such machinery is given in the

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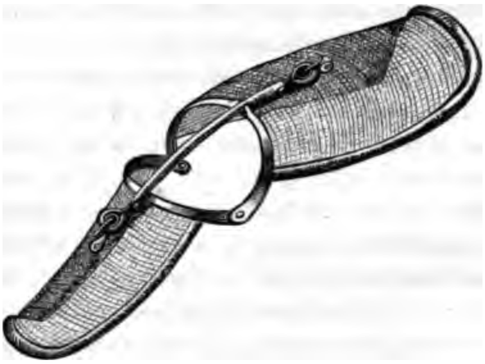
[1] Inflammation has ceased in these cases when there is no tenderness at the choice seats of pain, no heat, no startings, &c. See p. 151.

[2] One of these patients still uses two sticks.

Fig. 26.



Splint for flexed knee.

sequel. The same mechanism can be adapted to other joints of the body.

These principles, fairly carried out, are not remedies for inflammatory joint disease, since the first necessity for their adoption is that inflammation shall have ceased; they are rather a means of carrying out the good proverb, "Prevention is better than cure," a means of combating anchylosis while it is coming on, rather than waiting until it is established. The process of anchylosis is the same as that of cicatrization; as we would prevent such action producing contraction and deformity in one place, so ought we to prevent its doing the same thing in another.

Many cases, however, come under treatment when more or less deformity and immobility has existed for a considerable time. These may be caused, as we have seen, by anchylosis, with contracture of parts outside the joint, or by the latter condition alone. The anchylosis may be either true or false, and may fix the limb in almost any position.[1] It may also be simple or compound: the former term means that the joint surfaces retain their normal relations, the latter that the bones have been dislocated entirely or partially before they were united. These various conditions being in different degrees susceptible of benefit, are to be distinguished one from the other.

The diagnostic signs of true anchylosis are utter immobility, with which is combined a completely passive condition, and a more complete wasting of the muscles, than is ever found in the other forms of stiff joint. If the surgeon, grasping the limb, endeavors to decrease the deformity, the muscles at the opposite side do not get tense, or offer any sense of resistance, neither does the patient feel any pain on the side opposite the direction of attempted movement—that is, no pain on the flexor side, if the limb be drawn towards the position of extension, and *vice versâ*. If the joint be superficial, the surgeon's sense of touch distinguishes an evident unity, which, although not of import enough to form a diagnostic sign, aids as a confirmation. The ear may, I have found, be usefully employed to detect this difference, for by placing a stethoscope over either bone anchylosed to the other, and striking its joint fellow, a peculiar ring is heard, indescribably but utterly different to the sound carried to the ear when the bones are separate.

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[1] Some writers, chiefly Dr. Little, describe an angular anchylosis, and a straight anchylosis; the division is practically of little value for the subject now under consideration.

In false anchylosis there remains some degree, however slight, of mobility, perhaps a mere springiness, which is the more readily felt if the bones forming the joint be long. If the surgeon endeavor to decrease the distortion, the opposing muscles will become more rigid under his finger, and if the attempt at movement be carried further, pain will be felt upon the opposite side.

It is in a great number of cases perfectly possible to distinguish false anchylosis from mere contracture—that is to say, those cases in which the deformity arises from fibrous bonds inside, from those in which it arises simply and entirely from bonds outside the capsule. In the latter case, the movement is easy within certain limits, and it very rarely happens that equal contracture takes place on both sides the joint. In the former, the movement is not free, even in the narrow space allowed. The one feels like moving a hinge free within certain checks, the latter like bending a thick piece of gutta percha. It must be remembered that either form is seldom found unaccompanied by the other.

All these points are most easily made out while the patient is under chloroform. It is often unnecessary to give the anæsthetic simply for the sake of diagnosis, because the joint being falsely anchylosed, it is sufficiently flexible to prove the fact. In the contrary condition, however, when a joint is so stiff that no mobility can be ascertained, a true anchylosis should never be diagnosed until the effect of chloroform has been tried. It often happens that an articulation which appears utterly unyielding will, when muscular rigidity by means of chloroform be overcome, allow some amount of motion. Certain joints—as the knees, elbows, and others—which, lying in the middle of a limb, have a long lever both above and below them, offer considerable facilities for the detection of mobility; but if the articulation to be examined be either shoulder or hip, it becomes difficult to recognize whether the motion produced be due to the joint in question or to another part. This ambiguity is chiefly marked at the shoulder; it is all but impossible to fix the scapula, and even in health one can scarcely raise the arm from the side without moving the glenoid cavity. In children the sacro-iliac joint is very flexible, and in hip-joint disease becomes still more movable, so as to permit of a tolerable amount of apparent flexion and extension of the thigh without the slightest motion in the hip joint. Moreover, some of the muscles which are rendered most rigid on attempted movement, viz., the capsular group of both shoulder and hip, are out of reach of the finger. Our diagnosis may be assisted by the fact that true anchylosis of either joint is not common, in the shoulder indeed is excessively rare.

Now, whether the joint be fixed by a bony bond or by fibrous bonds, in or outside the capsule, the limb may be in any position. But, as we have seen in former chapters, there comes on during the inflammatory stage of a joint disease, contraction of certain muscles, which, if it be not resisted, acts on the limb, and in the vast majority of instances it is the flexors which are principally thus affected. Therefore, a limb which becomes fixed after joint-disease is usually bent, because all the parts which were inflamed consolidate their new tissues and mould them to this form, and because also the muscles do not of themselves give up the contracture they have assumed. The very term αγκυλος, a bend, a flexure; αγκυλοω, to bend; and ultimately, αγκυλως, in a crooked manner, shows that the fundamental meaning of the word is, that the joint is permanently flexed. But we occasionally find limbs whose bones are united in a straight position; an effect sometimes due to surgical management, sometimes to accident. Such position necessitates the use of the barbarism, a straight anchylosis. It is more fortunate for our terminology, than for the patient's power of movement, that such cases are somewhat rare.

It is in reality of little importance, as far as the principles of treatment are concerned, whether the bones be united in a more or less straight or crooked manner, although the condition will cause great difference in the details of procedure. The means at our disposal for overcoming the stiffness may be in the simplest terms described as, forcible movement to break up the adhesions, the knife to divide, and machines for slow expansion of contractures. The union of sudden, of gradual force, and of the blade leaves wide room for difference, according as one or the other be chiefly resorted to. Dr. Stromeyer, of Hanover, the inventor of subcutaneous tenotomy, used only the slow method of reducing deformity by means of apparatus which should, after division of tendons, exercise a comparatively slight but lasting traction on the limb. Dieffenbach, to whom this method appeared objectionably long, proposed and carried out sudden and forcible rupture, or stretching, of parts, without division by the blade.[1] Langenbeck, of Berlin, has carried on, and indeed has become the chief advocate of this system. Other surgeons recommend rather the union of force and tenotomy, after the method to be described.

The objections to each of the three means may be thus shortly stated. When a joint is anchylosed (falsely), and the tissues are pretty solid and firm, the method of Stromeyer, by gradual extension, is not only long and tedious, but often fails to effect the object. It is only to be trusted in recent cases, wherein the tissues are still weak and flexible. The method of Dieffenbach and Langenbeck exposes the parts to unnecessary violence; if the muscles and fasciæ be much contractured and strong, these structures may be torn; a nerve, or even an artery, may be lacerated; owing to such injuries inflicted upon the parts, mobility cannot be so perfectly restored as when contractures, being divided, less violence is necessary. The muscles of children, which can be readily overcome by very slight force, retract again, and are apt to produce secondary deformity, or to limit motion very considerably.[2] Any old scars of the skin are extremely exposed to danger of rupture, and when this happens, suppurative inflammation is violent and dangerous. Fourthly, the bones may be broken, or the epiphyses separated.

A combination of the two methods certainly offers the best advantage in all cases where contracture outside the capsule is considerable, and the position requires much change. Langenbeck urged against this method, that the wounds made by the tenotome will gape during extension, and air be sucked in, besides which they form points of departure whence cutaneous rupture may begin. This is certainly true; and it was once my misfortune to be present at an operation for extending the knee: both hamstrings were divided at the time, and the skin in the popliteal region split from side to side. It was, I believe, Mr. Brodhurst,[3] who first suggested the wise course of performing all subcutaneous divisions of fasciæ and tendons some days before extension is to be used, and not resorting to this part of the treatment until the wounds produced have become thoroughly and soundly healed.

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[1] Louvrier had previously invented an apparatus whereby the limb, being grasped in straps and splints, was suddenly extended by some irresistible machinery of screws and pulleys. The results were frequent fractures and lacerations, followed by such symptoms as necessitated amputation or caused death.

[2] Dr. Langenbeck asserts, that a contractured muscle does not, when the action of the will is suspended by chloroform, become lacerated during violent extension; the assertion, however, is not borne out by facts. "Commentatio de contracturâ et ankylosi genu novo modo violentæ extensionis osse sanandis." Berol. 1850.

[3] On restoration of motion by forcible extension and rupture, &c.

There is no doubt, however, that in every case, in which we would restore position to a diseased joint, it is not necessary to divide tendons.[1] This depends partly on the size and complication of the joint, the strength of the limb, and the age of the person. The stronger and larger the joint, the younger the patient,[2] the less change should be effected without tenotomy. It follows from this, that the angle at which the limb is deformed should have much influence in our choice of means: the greater arc through which we must move the limb, in order to restore it, the more necessary it will be to divide tendons, &c. Here also the size of the joint influences the decision, because we may effect a larger change in a smaller articulation, the elbow, for instance, without tenotomy, than we could justifiably attack by the same simple means at the knee. But all these points are again influenced very considerably by the length of period during which the inflammatory portion of the disease lasted, and the time that has elapsed since the joint was last capable of movement. These latter conditions will be more closely examined when we refer especially to the hip and the knee;[3] but it may be here stated, that in cases in which the primary disease was acute, or subacute, and of but short duration, the deformity and stiffness depend upon so small an alteration, that a very slight movement is able to overcome them. On the other hand, when the anchylosis has been established, after a severe chronic disease of long standing, and the deformity itself has lasted some years, the difficulty will be found much greater, and the precautions to be taken are more imperative. The following modes of procedure are only for severe cases, the slighter ones requiring no other description. Deformity from false anchylosis and contracture may occur at any joint in the body, and may be combined with partial dislocation. We will very shortly examine some of these, but will reserve the chief and most minute study for the hip, and more especially for the knee.

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[1] Lorinser's objections to tenotomy are stated in the sequel (p. 391).

[2] The muscles of children, being very small, are easily stretched, but they bear this act extremely ill, retracting afterwards again and drawing the limb into abnormal postures; hence, in an adult we may overcome an amount of contracture, which in a child necessitates tenotomy.

[3] See pp. 387 and 392.

At the shoulder true anchylosis is very rare; it is not very easy of diagnosis, as the mobility of the scapula renders it difficult to decide the amount of fixity that may be present in the joint itself. The best position for discovering this point is as follows: The patient is to sit on the ground, or on a low stool, and the surgeon, standing behind him, fixes the acromion and shoulder by placing one hand, with the thumb on the acromion, the fingers in the axilla; then he lifts the arm away from the side *without force*, and in a plane parallel with that of the chest; he will thus be able to detect whether or no any motion at the articulation take place; in all probability he will find some movement. An inflammation of this joint sufficiently severe to have caused false anchylosis will also have produced contracture of the scapular group of muscles, and in all probability of the long head of the biceps. All these parts are beyond legitimate reach of the tenotome, and he must trust to force only in order to re-establish the movements of the part. The patient, being subjected to the influence of chloroform, is placed upon the side opposed to that in which the disease is situated, and the operator begins the following manœuvres. Let me strongly caution the surgeon against beginning at once to force the arm away from the side in the direction above described, as such procedure is extremely likely to produce dislocation into the axilla. The first movement must be simple rotation; by bending the elbow at right angles with the humerus, and using the forearm as a lever, sufficient power is gained, and by grasping the upper arm as high as possible the surgeon can direct the force. Let him not, however, rotate the humerus further outwards than it normally ought to go. When this movement is pretty free, he places the arm in front of the body, and makes it cross the chest, till the elbow lies over the ensiform cartilage; he rotates the humerus a little while in that situation, then places the arm behind the trunk until the elbow lies just above the sacro-iliac synchondrosis,[1] in which situation the humerus is not to be rotated. Having thus loosened the adhesions to a certain degree, the operator holds the acromion and joint with one hand, in the manner previously described, and lifts the arm, as far as it will go, directly in front, *without the use of force*, and commences circumduction, endeavoring to make the arm describe as large a circle as possible: it must be brought to at least a right angle and a half with the body; this amount of elevation is the very least that should satisfy him; and the more he can raise the arm in this circumductory method the better. He will probably require assistance in carrying out these actions, but he should with his own disengaged hand hold the humerus, and govern its movement, and on no account should allow it to be forced upward directly from the side, or great peril of dislocation will be incurred. During all these manœuvres considerable extension should be made to diminish that risk as much as possible.[1] The hand in the axilla will enable him to judge very accurately of the effects that are being produced.

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[1] In obese persons neither this nor the previous posture can be attained to the full extent here described.

More or less immobility of the *elbow-joint* is a frequent result of its inflammation. If the surgeon have convinced himself that there is no true anchylosis (see p. 378), he next must determine which are the contractured parts. It is very rare that the posture during an inflammatory disease of this articulation has been such, that the arm is fixed in a straight position; still, it is frequently so much extended as seriously to diminish the use of the hand. In such a case it becomes a question whether or no it will be better to divide the triceps, and the answer must be sought from three circumstances: the age of the patient, the amount, and the duration of the malposture. If the person be under fourteen years of age, if a boy—twelve, if a girl—the muscle should be divided unless the malposition be very slight. In adults, if the arm be fixed at more than 120°, myotomy should be used in cases where the contracture is more than six months old, and the original disease have been something beyond a slight attack. Let us first suppose the muscle is not to be cut: the patient being subjected to the influence of chloroform, the first movement is to be simply rotation carried, if possible, to the normal extent;[2] the next is to be that which is the opposite of the particular mobility we wish to establish. For instance, if the elbow be too straight, we, desiring to procure flexion, must first straighten it still more,[1] and then flex it. In the same way, if it be immovably too much bent, we first bend it still more and then straighten it. Some care is necessary in effecting this last change. When the arm is overflexed, the surgeon should grasp the elbow-joint in such a manner as to keep his thumb over the head of the radius and biceps tendon. During the action of extension, which is better performed in a number of jerky actions than by a constant force, the above tendon may become perfectly tense, while the head of the radius does not follow the movement. The attempts at forcible extension must then be discontinued for a while. It may be that increased narcotism will cause sufficient relaxation, and a more careful and gradual mode of procedure will effect the object without injury; whereas a continuance of the same means would be very likely to produce dislocation of the radius.[2] It may be, however, that the biceps tendon must be divided, and it will be far better to perform this little operation than to run any risk of dislocating the radius forwards. In flexing an over-straight arm the surgeon secures a greater power by placing his knee in the bend of the elbow, but he must take care not to use sufficient pressure to endanger vessels and nerves; usually, indeed, sufficient force is obtained by the use of the hands only; flexion should be carried so far that the hands can be laid upon the pectoral muscle.

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[1] The after treatment being the same for all articulations, its consideration is postponed till the means of gaining mobility for all joints have been considered.

[2] The order in which the movements are to be established does not make it necessary that the one must, at all hazards, be accomplished before the other be attempted. It is sometimes impossible to rotate the forearm.

It has been said, that under the age of twelve or fourteen the triceps is to be divided, unless the amount of contracture be very small; but something must be added to this statement. If the triceps resist much in a person under eighteen, or even more, if development be retarded, it is better to cut the muscle than to run the risk of breaking through the epiphysis of the ulna—a mischance of serious import. The little operation is thus performed: The integument is to be drawn inwards as much as possible, and a puncture made with a sharp-pointed tenotome through the skin and superficial fascia, about an inch above the outer condyle, behind the strong piece of fascia, which here forms an inter-muscular septum. The operator substituting a blunt-pointed knife keeps the fore finger of his left hand a little outside the course of the ulna nerve, and passes the instrument between the muscle and the skin, with one flat side towards each structure, until he feels its end with the finger of the left hand. Withdrawing the knife a little, he turns it, with its edge to the muscle, and cuts it through to the bone while withdrawing the knife, taking care, however, not to continue the section up to the external puncture. This being completed, the patient is to be left until the wound in the skin has quite healed, and then the movements, above described, are to be put in force.

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[1] The reason of this is that there are two resistances to be overcome—that of fibrous adhesions in or outside the joint and contractures on the aspect of the deformity (flexor or extensor side of the limb). If, when the joint be over extended, we attempt its flexion immediately, both these resistances are met at once, and considerable force will be required: if, on the contrary, we straighten the limb before flexing it, the adhesions will be first broken down, and then the muscular contractures overcome; thus we may effect the object more gently and rationally.

[2] Such condition of parts is rare. I met with it in a case where the arm was bent at an acute angle.

The various *joints about the hand* are subject to disease, from which contracture may follow; the wrist is peculiarly exempt from such deformities, but the thumb and the fingers are more frequently attacked. These are, as far as I know, the only apparent exception to the general rule of the predominance of flexors. In these members, the extensors very frequently prevail over one phalanx, while the flexor predominates in another. Thus the first phalanx of the thumb will be over-extended, until it forms nearly a right angle with the metacarpal bone, while the second phalanx is bent very considerably on the first; and the metacarpo-phalangeal joint of the fingers will sometimes be over-extended, while the others are flexed. The exception is, however, apparent only, for the deformity is in every, or in nearly every instance, produced by contracture of the flexors. The insertion of the flexor tendons into the base of the second and third phalanx enables their contracture to produce great flexion of those joints, but has no effect upon the first phalanx. Such action produces a strain upon the extensor tendon, drawing the first phalanx, in which there is no resistance from flexors, backwards. Such deformity, when it arises from joint disease, is more often due to chronic rheumatic arthritis than to any other; from this malady, indeed, some of the strangest distortions of the hand arise. The condition, however, is very frequently derived from some neurotic affection; may follow a wound over the course of a nerve, or on the finger: it is sometimes impossible to trace its origin. Division of a flexor tendon is rarely necessary, an extensor need never be cut; the bent joint can usually be straightened under chloroform with the greatest ease, when the straightened ones will resume their natural posture, quite without external aid. A case occurred to me, in which, having straightened a finger, I put it on a splint in a flexed condition,[1] and the operation had to be repeated two days afterwards, since which I have always put up a straightened finger or thumb extended, and have never heard complaint, or found evil effects.

In hip-joint disease, the deformity arises, as we have seen, from certain remarkable alterations in the position of the thigh, which is first abducted, and then adducted[2] (according as the contraction of certain muscles predominates over that of others), and tends, throughout, to become flexed. At p. 382, it was observed that the duration of a joint-disease, whereby distortion was produced, must be gravely considered before any operation for its reduction be undertaken, because we can conclude, from the greater or less continuance of the original malady, on the amount of change which the articular surfaces had undergone. An acute or subacute attack, of inflammatory hip-joint disease, may have been subdued before abscesses had formed; starting pains, having been severe, may have had but slight duration; and though the muscular contraction continues as passive contracture, the actual inflammation will have lasted but a short time. Such cases are chiefly to be met with among adults, who have been exposed to vicissitudes of climate, great fatigue or other hardships, but occasionally occur also to impubic persons. They commence suddenly by an attack of pain, with rapidly succeeding spasm and distortion, and are thus sufficiently strongly separated from the slow form of strumous disease, beginning almost imperceptibly, and most commonly in children. We may form a very probable conclusion, as to the condition of joint surfaces, from this more or less rapid history of the case and from the absence or the amount of suppuration; whereby we may judge on the advisability of any operative procedure for amelioration of the condition left behind. The deformity which most detracts from the power of progression, is considerable flexion of the thigh upon the pelvis. We cannot form any conclusion, upon the amount of articular injury inflicted by the disease, from the amount of distortion left behind, for it depends upon many collateral circumstances; an attack from long exposure, combined with great fatigue, may, as I have seen, produce more deformity in a few days than will be caused by months of the strumous malady of childhood, although the articulation itself will be changed in much smaller degree. Yet considerable distortion has this effect, that while it renders change in posture more imperative, our prognosis of its effect must be in a degree less favorable, because even in the absence of articular injury, greater stretching of contractured muscle is not so favorable as less of that action. It is, however, wise to give no decided prognosis until, chloroform having been administered, it can be discovered, whether or no the distortion be not almost entirely muscular; it generally happens, in the case we have been considering, wherein no abscesses have formed, that the joint, which previously was fixed and rigid, becomes sufficiently flaccid to warrant our promising very considerable amelioration.

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[1] This, with other joints, is the rule. See p. 400.

[2] For more minute descriptions of these distortions refer to Chap. XIV.

The chloroform should have been administered with such an understanding, as shall leave the surgeon free to do much or nothing, as he finds the result of narcotism may teach: and if it turn out favorable, the adjustment of the limb may take place at once in the following manner. The patient lying on the sound side, the surgeon lets an assistant grasp the pelvis firmly, while he, by one or two jerks, flexes the thigh on the pelvis.[1] The adhesions yield with a peculiar short rending sound, and the movements of the limb become free. It is wise, however, also to extend the joint, a process which requires no force, unless a fibrous band remain unbroken by the flexion, and then it is necessary that this be ruptured, since otherwise the operation will have failed in its great desideratum; viz., procuring a straight limb.

On the other hand, we may be consulted, concerning a patient who had slowly run through all the stages of morbus coxæ, suffering much from starting pains, exhausted greatly by abscesses, and at last recovering painfully, with a distorted and shrivelled limb. The considerations in such a case regarding operative interference, become more grave and difficult, because it involves an amount of interference with parts which may be too much altered to submit patiently to disturbance. The question of operative measures or no, resolves itself into a comparison between the state of the patient at the time, the state in which he may reasonably hope to be placed, and the amount of risk incurred in the process. The distortion, viz., adduction of the thigh, which produces tilting of the pelvis, and apparent shortening of the limb, is not in itself sufficient to annul the power of walking; but when this is combined with a certain amount of flexion, the patient is in a very pitiable condition, and when the bend is considerable, locomotion becomes barely possible. Under such circumstances, we are carefully to consider the probable benefit to be gained, and the risk run by any operation.

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[1] In dealing with a child, even with a girl or lad of slight build, the surgeon will have power sufficiently to fix the pelvis with one hand himself.

If the head of the femur, having been dislocated during the disease, now lies on the dorsum ilii, it will have contracted certain adhesions, and the muscles will have adapted themselves to their new length and posture. The position of the thigh being usually, in such cases, one of considerable flexion, the limb is almost worse than useless, and very considerable efforts may justifiably be made to change this posture, to straighten and even to bring down the thigh. Such treatment may be undertaken with the more confidence, because we have not in such cases to do with a joint, nor with a bone impacted in an unyielding socket, but simply with one lying among fibrous adhesions. A very probable conclusion may be arrived at regarding the firmness and toughness of these bonds, as well as the unyielding nature of the muscular contracture, by considering the length of time during which the disease lasted, and the period elapsed since the deformity was established. No decision as to mode of procedure should, however, be determined upon until chloroform having been administered, the amount of easy and of forced mobility can be ascertained, and the condition of muscles examined. It will usually be necessary to perform myotomy upon the sartorius and tensor vaginæ femoris on the one side of the limb, and occasionally upon the adductor mass on the other, also upon the rectus femoris. Such wholesale division of muscles appears a formidable undertaking, but it is not so in reality; and as Mr. Canton advises, we may, by keeping the tenotome close to the pubic bones, avoid dividing the obturator vessels and nerves with the adductors.[1] The limb should not be straightened at once, but should be left until the wounds have healed. In from three to five days, the patient is again to be subjected to the influence of chloroform; the limb is to be first flexed, and then extended, then dragged downwards, until its length be as nearly equal to the other as can be managed without the application of an injudicious amount of power. Cold is to be applied to the part; but the limb may be put up straight, as we have not now a joint to deal with. I should recommend a Desault's splint, provided with pulleys, as described at p. 252, so that in from three days to a week extension may be employed.

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[1] I may refer to a case of Mr. Canton's, in which he divided the muscles above enumerated. Lancet, November 29, 1858.

But if the head of the bone be not dislocated, and if the disease have been of the slow wearing nature just described, we have no right to expect otherwise than that much change has taken place in the shape, both of the head of the bone, and the acetabulum, and that the new material which has formed is tough and hard. Let the reader refer to the woodcut at p. 360, and observe the oval or almost trilateral form which the head of the thigh-bone has assumed, and the perfect accuracy with which it fits the new portion of cavity it has hollowed out for itself. Now, it is evident, that if this patient, having recovered from all inflammatory disease, and suffering merely from the deformity left behind, had been subjected to powerful flexion, rotation, and other such movements, the bones must have been severely injured, and a new, very probably a fatal inflammation would have been lighted up. We have no possible means during life of forming a conclusion on the abnormal shape of the new articular surfaces, after many abscesses have been produced by a chronic joint inflammation, but we may very generally conclude that they have lost their circularity and perfect adaptation. Hence, in all such cases, any violent efforts at movement are unscientific and unsurgical, leading never to good, and often to evil results. It will not be always wise, even in a deformity with the above history, to express a decided prognosis before giving chloroform. When the anæsthesic has had full effect, attempts at movement may be made of such strength as would, in the cases first mentioned, be successful, and if no mobility be produced greater violence is not to be applied.

A hip-joint disease which has been treated by any method, whether M. Bonnet's, Dr. Bauer's, or Heine's, which keeps the limb in a direction parallel to the mesial line of the body, will prevent that extreme distortion (by flexion of the thigh on the abdomen) which forbids the foot coming to the ground. The deformity left after such treatment is adduction, with some rotation inwards, and apparent shortening of the thigh, the latter being produced by pelvic malposition.[1] Now, this condition produces an amount of lameness which, although distressing, is supportable, and does not prevent locomotion to an extent which would justify any interference so dangerous and so little satisfactory as that above described.

On the other hand, if the limb be permanently fixed by false anchylosis, and contracture at a right angle to the trunk, the life of the patient becomes so little enjoyable that he may be willing to undergo, and we should be justified in undertaking, any procedure whereby a reasonable chance of changing such condition for the better might be offered, and but little risk of life, or of making his situation still worse, were incurred. It only remains to choose that plan which best fulfils these conditions. Violent flexion and extension are, from the considerations detailed above, impracticable and worse than useless. Slow extension offers a far better chance of amelioration, combined or not with myotomy, according to the amount and duration of distortion.

Lorinser, of Vienna,[2] objects to tenotomy, and apparently on the grounds founded upon its effects if mechanical stretching be undertaken immediately after the operation, and also upon its uselessness. On this latter point (particularly in the case of children) I must quite differ from him; it is true that we may not be able to divide all contractured muscles, but that is no reason why the accessible ones should not be cut. The psoas and iliacus, which we cannot reach, do not, I believe, play the chief part in hip-contractions; on the contrary, their contracture is secondary, produced by, and not producing, malposture. However, urged by his views on this subject, Lorinser constructed, both for the hip and knee-joint, a machine which, in some parts like Louvrier's, is in others more complicated, and has many useful additions; moreover, he does not desire the sudden violence, used by Louvrier, to tear or break all resistant structures. We cannot here describe the apparatus; it will suffice to say that Lorinser hit upon the clever idea of reversing the mode ordinarily in practice, which was to make the pelvis and trunk the fixed point, and to straighten the thigh upon them. He fixed the limb, and used the weight of the body as a portion of his power. The patient lying on the back, upon a flat, hard bed, has the thigh in its ordinary attitude fixed into an angular splint. When the angle of the splint is depressed, the pelvis rises into a more perpendicular position, the loins become arched (p. 305). But such posture cannot long be borne, and after some hours the lumbar region becomes flatter, the pelvis more horizontal—that is, since the thigh is fixed, the hip-joint becomes straighter. Hinges in the bedstead afford means of depressing the shoulders; a screw, of raising the pelvis; so that, were it desirable, the whole figure might be arched backwards.

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[1] My belief is that even these last deformities will, in nearly all cases, be very much diminished or prevented by the use of extension, as described at p. 325. In none of the cases thus treated has distortion arisen, and in those in which it was already present it yielded markedly to the tractile force.

[2] "Die Behandlung und Heilung der Contracturen im Knie und Hüftgelenke." Wien, 1849, p. 47 et seq.

The radical defect in this very clever invention is, that it is so terribly mechanical, treating patients like so many insensible pieces of metal, to be rolled out, or squeezed into different shapes; and as the confinement upon this Procrustean bed is to continue from four to six weeks, there are but few persons who can bear the treatment; indeed Lorinser acknowledges that it is necessary, in order that the patient may not be too thoroughly worn out, to permit him to sit up for about half an hour in the day. I have treated two cases of hip contracture with my extending splint, which does not confine the patient to any attitude, and have in each case succeeded in bringing down the thigh. The contractures were neither very considerable nor old, but from the rapid way in which the deformity yielded, I am led to believe that very much may be effected by this splint, particularly as, by using a number of accumulators, the power is virtually unlimited.[1]

The amount and mode of surgical interference with a falsely-anchylosed *knee-joint* that may be either justifiable or valuable, is a matter of very grave importance—one that it behooves us to examine with the greatest care. It is evident that the first point for the surgeon's attention is, as in the last instance, to make a mental comparison between the condition of the patient at the time and the state in which he can reasonably hope to be placed by the operation: then he must calculate the amount of danger to life or limb, and conclude whether the gain be worth the risk.

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[1] A great defect in all instruments adjusted by screws, ratchets, levers, and the other ordinary mechanical contrivances, is that when the position is altered, there is for a time some painful stretching; then the muscles rally, and acquire force for renewed resistance at the next alteration. The constant, yet never unyielding, force of the spring overcomes all such action with infinitely greater ease and very much quicker.

The first point, the condition of the patient at the time, is very various, and depends upon the amount of deformity. When the knee is straight, or nearly straight, the person can walk with considerable ease by means of a shoe thicker in the sole than the other, according to the angle at which the joint is bent. There is, however, a degree of flexion which renders locomotion difficult and inelegant. An angle as small, and *à fortiori* smaller, than 135° has this effect; combined with such flexion as this, there is usually a twist outwards of the tibia (rotation), and frequently the knee is bowed inwards (abduction of the leg). These latter, which are of secondary import, will be noticed presently. Now, a young person whose knee is anchylosed at an angle of 135° or less, is generally very lame; a shoe, or a stilt six inches high, may be scarcely enough to equalize the limbs. In order to walk at all, for which purpose the leg must approach the perpendicular, the thigh must be bent on the abdomen, and therefore the body inclined so far over to the diseased side that the whole figure is twisted, and will probably become permanently crooked. The power of healthful exercise and enjoyment is thus so much diminished that strength fails and life becomes miserable. Moreover, if the person have not yet attained maturity of growth, the angle of flexure constantly diminishes, either from some law of growth in the joint ends, or from the influence exercised by the weight of the body.[1]

The second point, the state in which the patient can reasonably hope to be placed by the operation, depends on several circumstances—the age of the person, the particular malady which produced the anchylosis, the more or less chronic form of that disease, and the length of time during which the joint has been fixed. It is scarcely desirable to enter into the physiological and pathological reasons which render any operation a more hopeful procedure in youth than in age; it is only necessary that such condition of success, or the reverse, should be mentioned. We have seen, in several previous chapters, that inflammation beginning in the synovial tissues spreads to the bones, and *vice versâ;* and that by disease following either mode of commencement, the cartilage, and a certain amount of the underlying bone tissue, may be destroyed.

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[1] I have seen this in every case in which, false anchylosis being established before the eighteenth year, I had opportunities of watching the cases afterwards.

We have, therefore, not now to do with the commencement of the malady, but should endeavor to discover if the articular surface have probably undergone any considerable amount of change. If we find that sensible portions of dead bone came away during the progress of the disease, or that the articulation became easily movable in abnormal directions, it may be safely inferred that the form of the joint-end has undergone much change; and such inference will be aided, if we discover, by the history from the medical attendant, that the malady was in the beginning one of those slow diseases of the epiphysis in process of ossification.

The more or less chronic form of disease whereby the anchylosis was produced, and the duration of its existence, are of very great importance, as having reference to the toughness and unyielding, or to the more or less flexible, condition of the tissues. A chronic inflammation, which takes time to form its new productions, nearly always makes them in the end tough and hard. Moreover, an anchylosis resulting from a chronic malady is generally spread over the whole or great part of the joint-surface, and in valves much peri-articular tissue. On the other hand, an acute, or even a subacute, inflammation, following perhaps an accident, is too rapid for the production of strong, tough fibro-cartilaginous growths; on the contrary, it forms a far less firm sort of areolar tissue; and when any union between the bones results from such an inflammation, it is very rarely spread over a large portion of the joint-surface. Closely connected with the last of the three circumstances offered for consideration, is the question we examined at p. 375, namely, the unwisdom, when an inflammation has ceased, of permitting the anchylosing material to become hard and unyielding. It is evident that the more chronic be the malady, the more necessary it is to prevent such an occurrence, because the new tissue is spread over a much larger surface.

Yet there are cases in which, from a variety of causes, it has been impossible to find a period in which such means could be fairly resorted to, or the case comes to us already anchylosed. It will have been observed that there is no fixed point of time at which this process either begins or ceases; it is a gradual consolidation of the parts, a filling up and cicatrization of the cavity. Now, the earlier we can procure some motion, the more hope may we give the patient that mobility will be preserved. The duration of the anchylosis is not to be calculated from the time when the disease first commenced, but from the point when the tissues began first to solidify. This can usually be ascertained, even from a past history, as the period when pain ceased, swelling did not increase, sinuses closed and the health began to improve. The longer the interval which has been allowed to elapse since this occurrence, the longer time must be spent in endeavoring to restore mobility, and the less, *cæteris paribus*, shall we be able to accomplish.

However, it is not necessary, nor even desirable, to be content with inferences drawn from past events. We may give chloroform, and examine into the more or less flexible or inflexible condition of parts, with, if it be expedient, the express understanding that we do not intend to make any change, even in the position of the limb, unless it appear safe and feasible. After stiffness has lasted some months or years, depending, more or less, upon the age of the patient and the chronicity of the disease, and if we find that during such lapse of time very hard inflexible tissue unite the bones, we cannot expect to procure any permanent mobility. At first, after breaking up the anchylosis, we can by the means of the various machines invented for the purpose, continue a capability of passive motion; perhaps, while no weight is placed upon, or other action is going on in the limb, a slight power of actively moving it may be preserved; but if the machinery action be discontinued for even a short period, sometimes even in spite of its constant use, the joint gets stiffer and stiffer, until it is set fast again. Occasionally there occurs an exception to this rule, but we do not form our prognosis on exceptional cases, and it is certain that when the tissues have had time to form a tough fibro-cartilaginous bond, extending over the whole joint surface, the surgeon should not give his patient hopes of regaining a movable joint by breaking it through. Thus, we must return to our original questions regarding the condition of knee-joint (p. 392), justifying surgical interference, and answer them thus—that if the limb be in such posture as to permit tolerable locomotion, it is wrong to break down an anchylosis large, old, and inveterate enough to require more than a moderate exertion of force; that if the limb be in a position which renders locomotion hardly tolerable, it is justifiable to use a great amount of force to break down the anchylosis, and restore the limb to a fair position. Or, to put it in other words, the use of considerable force is justifiable for the reduction of a malposture of the knee-joint, but unjustifiable for the re-establishment of mobility in a joint already in a good position.

Having decided these questions affirmatively in any especial case, according to the principles above defined, the surgeon must next consider whether he will operate after Dieffenbach's and Langenbeck's method, by mere force, or whether he will cut some of the tendons and thereby facilitate the reduction. In determining this point he must especially consider the other deformities which are nearly always combined with flexion, namely, rotation and abduction of the tibia. This condition is, as M. Bonnet very properly observes, impossible in a straight position of the knee, while the articular surfaces retain their normal form; but when the joint is slightly bent they become possible even during perfect health. Rotation outwards is produced by the tensor vaginæ femoris muscle, its antagonist being the popliteus. The position and value of the former muscle, or rather of its fascial attachments at the leg, must be borne in mind: the outer part of the fascia lata descends upon the leg, where it becomes continuous with a like structure investing the muscles of that part; but a portion of it near its middle is inserted into the head of the fibula by an especially strong band of fibres, which represents, in fact, a tendon prolonging the action of the muscle to that point, and enabling it to produce the above-named action; moreover, be it observed, that when the knee is straight this mode of attachment causes the muscle to aid in keeping up this posture, but when the joint is bent the muscular contraction assists in the flexion. The tensor vaginæ femoris is not itself interested in knee-joint disease; but let the position of this band of fascia immediately overlying the subsynovial tissue be remembered, and it will at once be seen that an inflammation of the parts about the joint must involve that structure, producing, as is always the result of facial inflammation, very considerable and firm contracture. Hence, as said above, in nearly all cases after a disease of the knee-joint, flexion is combined with outward rotation. The abduction of the tibia is produced by the same cause, added to contraction of the biceps tendon. Now, in deciding upon the course of procedure to be adopted for a case combining all these three distortions, the two minor ones must not be neglected, for it assuredly happens that if we straighten a joint so deformed by mere force, the outward rotation and abduction will be increased. One other point must be noticed, viz., the amount of firmness with which the patella is fixed to one or the other condyles of the femur. This bone is generally attached much more firmly than the tibia to the femur (in false anchylosis), indeed is sometimes truly anchylosed, while the adhesions of the latter remain fibrous. The usual point of junction is on the outer condyle, and sometimes so low down that the tibia cannot be raised without destroying the union, an impossible event if the attachment be bony. In this last circumstance, application of undue force may produce dislocation of the tibia into the popliteal space. The condition of this bone will be best ascertained while the action of chloroform prevents any voluntary or emotional muscular contraction—when pressure upon its upper or lower margin will, unless the union be firm, produce some slight elevation of its opposite edge.

We will suppose that a simple anchylosis, in a flexed posture, unaccompanied by any other deformity, or by very firm adhesion of the patella, having been diagnosed, forcible rupture of the false anchylosis has been decided on. The following is the mode of procedure, as practised formerly by Dieffenbach, and now become a recognized treatment for anchylosed limbs, although the principles insisted on by the originator of the method are frequently not sufficiently followed out.

The counsel offered at p. 385, regarding the value of first causing that movement which is the opposite of the posture to be established, is to be more strictly enforced in this large joint, especially if the anchylosis be firm. Moreover it is necessary that during all the movements, and more particularly during the act of straightening, considerable extension be kept upon the limb to prevent dislocation; for this purpose the surgeon places one hand in the popliteal space, at the back of the tibial condyles, dragging them forward, or if much force is to be used, the forearm close to his elbow will give more power in preventing dislocation of that bone backward. During the operation an assistant must grasp the thigh just above the knee and make powerful counter-extension. The patient may be placed on the back, or if much resistance be expected, he may lie on the face with the front of the thigh reposing on and supported by the table.

In every case in which much deformity is to be overcome, in which the above-described secondary deformities exist, and always in children, contractured tendons and fasciæ are to be divided. In the position of flexion, these are the hamstring muscles and the fascia lata, on the outer side, particularly that portion which is attached to the head of the fibula. The operation, always to be performed some days before the extending force is to be used, is thus conducted. The knife should, both on the inner and outer side, be passed to the deep surface of the part to be severed, and the division take place towards the surface. The parts at the inner side may best be reached from the popliteal space: the skin, being drawn inward as much as possible, is, with the fascia, punctured by a sharp-pointed tenotome, some distance from the edge of the muscle: a blunt-pointed instrument can then easily be made to glide along the outer and deep portion of the tendon, with its flat surface towards that structure, until the end of the instrument be felt by the finger of the left hand to touch the deep surface of the skin anterior and inside the tendons; a movement of the knife-handle will then sever those parts. The proximity of the popliteal nerve to the tendon of the biceps renders it necessary to be more careful in dividing that structure. The usual method is to draw the skin outward and to puncture it between the nerve and tendon. This makes but a very short subcutaneous channel; moreover, if it be likewise necessary to divide the fascia lata, it can hardly be effected from this point. The method of Bonnet is, therefore, preferable; it is thus performed on the right leg: The surgeon, placing his left forefinger on the inside of the biceps tendon, will, except in a very fat person, be able to feel the projection caused by the popliteal nerve; and can even, by a little pressure, insinuate the tip of his finger between the two structures. The thumb of the left hand is laid upon the thigh about two inches above the outer condyle, and draws the skin backward at a point opposite the forefinger of the left hand, and about three inches in front of it the sharp-pointed tenotome penetrates the skin and fascia; a blunt-pointed instrument, with a long rounded portion, and but a short cutting blade, is substituted, and easily glides along the deep aspect of the fascia with its edge upwards, till it impinges on the skin over which the left forefinger lies. The biceps tendon is then partly to be pressed against the sharp edge turned towards it, partly divided by movements of the blade itself. The breadth of the fascia from the muscle to within a line or two of the external wound, is to be severed in withdrawing the knife. No attempt, as already has been said, is to be made to straighten the limb until the external wounds have soundly healed. A few words must be said regarding the mode of procedure advantageously to be adopted in cases of very firm, even true anchylosis, at an inconvenient angle, occurring in impubic persons. In some cases of this sort a wedge-shaped slice has been excised from between the tibia and femur sufficiently thick to allow straightening of the limb. Such operations may, in certain instances, be justifiably performed upon an adult; but I cannot conceive them to be necessary in a person under fourteen years of age. The epiphysis of the tibia, which has not yet united, should be in such cases broken through, and the leg be brought into the same line with the thigh. The upper truncated end of the diaphysis will then rest against the angular edge of the epiphysal end, and the limb will only be shortened by little more than an inch. I have never seen any evil result follow such practice; the parts unite firmly and well; the patient gains a useful although a stiff limb. The angle of anchylosis must be very acute to cause this operation to endanger permeability of the popliteal artery; but it is wise to place the splint (which should be applied at once) at the side, not at the back of the limb, and to avoid causing any pressure by the bandage, or otherwise, over the artery.

Dr. Max. Langenbeck,[1] of Hanover, has recently published a pamphlet, concerning the forcible fracture of true anchylosis at the knee-joint, relating certain cases wherein its success was undoubted. In other hands the procedure has proved less fortunate. He speaks of insuring the place of fracture by pressure with the hands; but this seems extremely likely to fail. Lorinser[2] employs a splint inclosing thigh and leg with a hinge at the knee, and a screw so adapted that the angle can be gradually obliterated. The limb fixed in its abnormal posture into this splint is gradually screwed to a straight position. The proceeding is both painful and wearisome, but is certainly very powerful, and will cause contractures to yield that could hardly be otherwise overcome. He affirms that true anchylosis of the patella is no obstacle to his treatment, as in certain cases he succeeded in straightening the joint, the union between patella and femur still continuing. It may be added that in cases of recent contracture, if it be not thought desirable to use forcible straightening, my extending splint will be found very efficacious in overcoming the deformity.

In cases in which the anchylosis following a chronic disease has been so firm that we cannot hope to restore much mobility, the joint, after forcible rupture of the fibrous bonds. should be kept in that position which we wish it to retain.[1] But after breaking down a slighter union, when we are justified in endeavoring to procure mobility, the after treatment, except in the case of the fingers, is the same for all joints.

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[1] "Ueber gewaltsame Streckung der Kniecontracturen," &c., 1858.

[2] Op. cit., p. 6 et seq.

Before such an operation is undertaken, a gutta-percha, leather, or pasteboard splint is to be moulded on the limb, in the abnormal position, whatever it may be. When the joint has been straightened, or rendered mobile, the limb is to be bandaged into this splint, therefore in the posture it had assumed before any attempt at change had been made. Cold lotions, or, if much force have been used, ice is to be applied; if inflammation come on, some active treatment—leeches or the cupping-glass, diuretics or febrifuges, according to the systemic power, may be employed. After three days, if no inflammatory attack have supervened, or after such action have been subdued, passive motion (except in rupture of the tibial epiphysis) is to be gently and carefully commenced. Various machines for facilitating this latter action have been invented, and are used with more or less benefit. M. Bonnet has invented, and Mr. Bigg, the ingenious mechanist of Leicester Square, has adapted, for the knee-joint, a splint with a hinge, to the tibial part of which a lever is adapted, whereby the patient can, by his own manual force, alternately bend and straighten the joint. M. Bonnet also used a rope, passing from the patient's hand, through a pulley, to the ankle, for the purpose of allowing the patient to produce extension. I have somewhat changed this mechanism by using the splint described and figured at p. 377, allowing the India-rubber to act as the extending force, the rope passing through two pulleys to be the flexing power. Such little variations, however, are of secondary import; surgical skill, which always connotes a certain mechanical ingenuity, will adapt the proper mechanism to each case. The essential point is so to manage that the patient applies sufficient movement to establish permanent mobility, but not enough to set up new inflammation.

CASES OF THIS DISEASE.

CASE LIX.—Mrs. Williams, aged 43, charwoman, came to me on July 29th, 1859, in consequence of her left elbow having become bent and useless.

She stated, that rather more than seven months ago she fell down and sprained her arm: the elbow swelled, and was very painful. She went to King's College as an out-patient, was leeched, and then blistered, several times; that the arm was put on a bent splint; ultimately the pain ceased; the splint was left off, but she cannot get the arm straight, nor can she bend it beyond its ordinary position, except to a very slight degree. (She probably had acute synovitis.)

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[1] After rupture of the epiphysal junction, as above mentioned, the limb should be put on a straight splint.

The arm, which is flexed at about a right angle, can, by the exercise of some little force, be slightly straightened and bent out of its present position. The joint is not tender to pressure, but there is a good deal of thickening about it. The biceps resists considerably; this appears an effect rather of active contraction, voluntary or emotional. I had chloroform administered, and on examining the part, while she was unconscious, found that there was hardly more mobility of the joint, but that the muscle did not check it to any degree worthy of consideration. An exercise of no great amount of force sufficed to straighten the limb. It was put on the bent splint, and she was ordered to keep the bandage wet with cold water.

Aug. 1st. There has been no inflammation, and but very little pain, which is occasional only, and in short spasms. Splint removed; passive motion which caused very slight pain was employed, and the limb bandaged on a splint nearly straight.

7th. Passive motion again employed by one of my dressers, and the arm replaced on a perfectly straight splint.

15th. She has been twice subject to passive motion, rubbing, and alternate application of straight and bent splints. A gutta-percha splint was given her, and she was told to get some straps, with directions to use passive motion, and rubbing herself frequently during the day, and to strap on the splint at night.

31st. Came to be discharged from care; she has been employing herself at her usual work, sparing the arm as much as possible; but she has now very good motion; can very nearly straighten the joint, and can put her hand to her mouth, and says her arm gets strong.

Case LX.—Elizabeth Jay, aged 13, was brought to me at the Charing-Cross Hospital, October 26th, 1859, by her mother. When quite a young child she fell, and, as her mother says, broke her finger.

The ring finger of the left hand is flexed in the first phalangeal joint at so acute an angle that the end of the finger is immovably in the palm of the hand; there is no sign of any former fracture, but the joint is thickened. The mother wished the finger to be removed, as it rendered the whole hand useless. On examination, I found there was false anchylosis of the joint; the flexors were, however, so tight, that to endeavor to straighten the finger without their division would have been useless. I explained the possibility of restoring the use of the part, and passed a tenotome under the flexor tendons, divided them from within outwards, about the middle of the first phalanx, and bound up the hand without straightening the finger.

31st. Straightened the finger and put it on a straight splint.

Nov. 4th. Let passive motion be used, and put the finger on the splint again.

14th. The same plan has been adopted of frequently using passive motion. The straight splint has been kept, because it seemed better to forestall any possible recurrence of retraction. She is now to leave off the splint, move her finger about, and use it in the day, but to have the splint at night for another fortnight.

Dec. 31st. Saw this patient, who has full use of the hand, and no deformity but a slight enlargement of the joint.

CASE LXI.—John L——, aged 10, had suffered when five and a half years old from knee-joint disease, for which he was treated in Shropshire. The knee is bent at an angle slightly acute; the bones are in their proper position. It was in consequence of this malposition that I was consulted, February 7th, 1859.

There is some slight mobility in the joint; it can be flexed a little, so little that the movement is felt rather than seen; it cannot be straightened in the least. The boy is healthy and strong, but walks with crutches. Chloroform was administered by Mr. Harrison, and it was then possible to attain greater mobility of the joint; it was found that the patella was not anchylosed by bone to the femur. The flexors strongly opposed any efforts to straighten the limb; the biceps was chiefly tense; a tenotome was passed in on the outer side of the thigh, and the tendon divided about two inches, or a little more, from its insertion; the posterior edge of the fascia lata was cut through from the same puncture and without removing the knife, and the tense inner hamstrings were also divided.

12th. The small wounds in the skin having soundly healed, chloroform was again administered. When fully under its influence the patient was turned over so as to lie upon his face, the front of the thigh lying along on the table, a pillow beneath it. Mr. Harrison held the thigh firmly, so as to exercise counter-extension. I placed my left hand in the bend of the knee, behind the tibial condyles, my right at the back of the malleoli, and sawing simultaneously upon both began to straighten the joint. When the limb had moved through a certain small space a rather sharp breakage sound was heard, followed by a dull rending, and the joint became much straighter. When it had been extended to about a right angle and a half, or 135°, I could get it no further. Examination showed that it was the firm anchylosis low down of the patella which prevented further straightening. A little consideration induced me to turn the patient on his back, to place a book about an inch thick under the tibial condyles, and to direct my coadjutor to make firm, but not violent, traction on the tibia below. By these means I hoped to prevent either dislocation of the tibia backwards, or rupture of the epiphysis, while I was pressing the knee downwards. The parts resisted much less than might have been expected, and in a short time I had the satisfaction of feeling the patella yield, and of restoring the limb to a perfectly straight position. The splint, previously moulded to the deformed posture of the limb, was applied, and the patient taken to bed. Ice-cold water to be applied to the limb.

15th. The boy had some, but by no means severe, pain for about sixteen hours after the operation. I took off the splint and moved the joint a little; some pain was produced, but motion was not carried far—a Liston's splint with a screw at the back.

22d. Much more movement can now be borne, and he can place a little weight on the foot.

August. The patient had very fair mobility of the joint, and the muscles of the limb are daily increasing in size; he walks with one stick only.

CHAPTER XVIII.

ON THE REMOVAL OF DISEASED JOINTS.

A.—*On the Circumstances which justify Removal of a Joint.*—There is a certain state and period of joint-disease, which not only warrants the surgeon to recommend removal of the part, but which renders any other course unjustifiable. The variety of circumstances which call for operative interference may be summed up in the following manner.[1] Removal of a joint may be called for: to save life in the height of an acute disease; to shorten the wearing processes of a chronic and incurable disease; to rid the patient of a deformity and incumbrance.

In the first of these, the surgeon is called upon to form a rapid decision, and to act upon it. He has nothing to do with collateral considerations, but has simply to judge: Whether the system will succumb to the disease before the part can be restored? and, whether any operation will place the patient in a better position? The answer to the first question must be decided according to the principles of general surgery, whose consideration hardly comes within our scope. The amount of febrile excitement and exhaustion must be contrasted with the amount of power, and the result compared with the quantity of local repair necessary before the violence of the irritation will be subdued, and with the probability of so excited a system performing those actions at all. It must be remembered that few local surgical conditions can be worse than a joint acutely suppurating, the cartilages detached from the inflamed bone, the deep cavity full of purulent matter, putrid, or on the verge of putrefaction; the bone cancelli filling themselves with pus, the limb swollen by acute œdema, the patient almost prostrated by the pain. The general condition will be that which always accompanies such local manifestations: a low typhoid fever, ending very probably in purulent infection. We have seen that in the early part of suppurating synovitis, free incisions into the joint at some depending part greatly relieve all the urgent symptoms, and may save the limb. Such treatment is scarcely successful except in the commencement of the disease; its value, and the chance it may afford, are not to be neglected; if after a time, the oppression of system be diminished, we may postpone the consideration of operation; and if ultimately that last resource must be resorted to, the patient being in a less oppressed state, will bear the operation better. If a free outlet for the pus do not speedily relieve, removal of the part will probably be the only hope; and while the surgeon should not hurriedly decide to sacrifice the limb, neither should he postpone his decision until danger from purulent infection be imminent.

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[1] Malignant and sarcomatous disease are not noticed.

In considering the state of parts implicated in a suppurative synovitis, we have very much answered the question as to whether operation can put the patient into a more favorable position. Certainly, the clean edges left by the blade are much more tolerable to the patient than the condition above described; and when there is some systemic power left, it frequently happens that, in twenty-four hours, the typhoid symptoms have disappeared, and the patient seems restored to life. On the other hand, when vitality has been much depressed there is hardly any rally, the wound suppurates unhealthily, does not unite, and the whole condition appears hardly improved by the operation; if the shivering of purulent infection have come on before ablation, the patient has but a very poor chance of escaping with life.

The difficulty of accurately and justly judging, under the circumstances above noted, becomes facility when compared with the discernment to be used when a chronic disease has entered into such a stage, that operative interference comes at all into question. The slower form of malady gives the advantage of allowing the surgeon a longer time for decision, so that he can positively try the reparative powers against the morbid state. On the other hand, so many points must be considered, all of them bearing with different weight and in different direction upon the question, that it is scarcely possible to epitomize, within a small compass, the mode in which the subject of removal or non-removal should be considered. The most essential questions are: Is the constitution capable of ultimately conquering and healing the disease? If so, will the limb be of value, or an encumbrance? In the worldly circumstances of the patient, is it possible for him to await a long, and perhaps a doubtful, process of cure?

The first of these three queries, that on which the others hang, is most difficult to answer, whenever the question arises at all; that is, whenever there is such a nice balance between disease and health as to render the issue doubtful. Of course we have the same comparison to make between the constitutional vigor and the repair necessary, but both points are very difficult of judgment, and must be separately estimated before they can be contrasted.[1] In the first place, the diathesis, whereto the long continuance of the chronic disease is owing, must be taken into account. A rheumatic malady connotes one constitutional evil, a strumous disease another; and the effect upon the system of allowing the persistence of a topical evil is different in both. It has been already pointed out (p. 174), that persons suffering from the former kind of arthritis are liable to a peculiar form of bronchitis, and we know that in such diathesis atheromatous degeneration of the arteries, or disease of the heart, is a common occurrence. It would be false to affirm, that the joint disease had any direct effect in causing or hastening such changes, but the irritability, confinement, and wearing of the system, which are always produced by long continuance of a joint-disease, certainly place the body in a condition which favors the progress of such morbid actions. The effect, however, of local rheumatic disease upon the general system, is much less marked than that of a strumous malady. Some persons look upon the scrofulous diathesis as an entity which necessitates diseased action somewhere, and they even believe that, by removing its manifestation in one part of the body, we only transfer its appearance to another place. The actual fact is, it seems to me, very different indeed; as I believe that scrofula does not consist of a *materies morbi* which must have exit, but in a state of ill-nutrition; it follows from such credence that anything which draws largely on the sustaining power of the system, must of necessity be held to increase the nutritive fault. In watching cases of strumous joint-disease it is impossible to avoid being impressed with the relation between the demands on the system made by the original disease, and the establishment of fresh strumous phenomena in other, generally internal organs. As in an acute suppurative synovitis, purulent infection is to be dreaded,[1] so in rheumatic joint-disease we must expect a condition tending to atheromatous cachexia, and in strumous maladies, tuberculosis. The signs of an atheromatous condition are most obscure and difficult. I do not pretend either to be sure of them, or to describe them; but believe it possible to recognize a peculiar expression of face, a tinge of the conjunctivæ, a condition of bronchial membrane, an irritable form of fever, with rather hard sharp pulse, and dry furfuraceous skin, which would indicate approaching danger.

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[1] Although in a verbal description of the mental processes to be gone through this separation holds, the surgeon does not divide so entirely his local from his general investigation, since some part of his knowledge concerning the constitutional condition must be gathered from the phase of the local malady.

In a strumous form of malady, it is a condition of chronic hectic (the only term applicable that I can find) which is to be dreaded. A mere passive state of superabundant granulation, such as is described at p. 120, very rarely, if ever, induces such a condition; but a considerable amount of suppuration, or the peculiar nightly pains of joint-disease, is accompanied by an irritability which is always combined with defective nutrition, and by danger, therefore, of further strumous manifestation. The peculiar starting pains, upon which so much stress has been laid, very often affect the health in a strongly marked mode, and bring down the constitution in a manner more rapid than I have observed in any affection not produced by a morbid poison. Indeed, were it compatible with the plan of a work professing merely to be a matter-of-fact investigation into a surgical malady, a good deal of true, but rather vague writing might be expended on the "physiognomy of joint-disease." Every surgeon, however, dealing with far advanced and painful articular affections, recognizes, consciously or unconsciously, certain changes of countenance, which warn him that the constitution is yielding to disease. If to such signs be added the daily increase in the irritative fever, and the exacerbation of the local malady, there will be sufficient grounds for drawing a legitimate conclusion. So much has been said, in previous chapters, of the different local conditions produced by articular disease, that little beyond a short summing up is necessary. Rheumatic synovitis less commonly than the strumous, induces a state which requires removal for the sake of saving life. The non-suppurative and non-degenerative quality of joint-disease, arising from or prolonged by that diathesis, has been discussed. The patient, who is affected by such malady, does not suffer from the wasting effects of large abscesses and drains upon the system;[1] but, on the other hand, such maladies do not often tend to cure by obliteration of the cavity when the cartilages have nearly, or entirely disappeared,[2] but they produce very considerable pain and sleeplessness, thereby setting up an amount of irritative fever. This latter condition must be taken in connection with the difficulty of cure, and be weighed against the absence of physical drain caused by the malady, and the fact that throughout the disease exacerbations and ameliorations are to be expected.

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[1] Accompanied by deposits of pus in internal organs.

The disease called chronic rheumatic arthritis, and which I have ventured to describe as a rheumatic osteitis, is of a character not sufficiently local to need consideration here.

Strumous inflammation, to which by far the larger number of joint-diseases requiring removal are due, attacks, as we have seen, primarily either the bone or the synovial membrane; by the time that the affection is so advanced that its removal comes at all into consideration the place of origin is unimportant as influencing that question alone. The local conditions, which promise still further impairment rather than improvement, are—plentiful degenerations among the new tissues; wide-spread abscess among surrounding parts; a certain suppurative tendency which must be described in the sequel. Many joints have been amputated, or excised, on account of sluggish strumous swelling, without abscess, or other wasting condition—such state as a local malady only, the general health being unaffected, does not, as we have seen, necessitate such interference. As long as the subsynovial tissues are granulating, the only fault being want of development beyond the crude cell-formation, it is competent for treatment to produce an action that shall cause some further organization, and thereby improvement. When much of the tissue is degenerating and suppurating, and abscesses form at distances from the seat of injury (the deeper and the closer to the bone the worse is their prognostication), more particularly if fragments of bone come away with the pus, the state is such as may hardly get well without a severe trial to the constitution; but if the health continue firm, even these local evils should not make us despair, for it may happen that some sudden change in the circumstances—a dislocation,[1] partial or total—causes a great amelioration in all the conditions, and the patient gets well with but little further difficulty. There is another condition, which appears to consist in osteal and periosteal irritation, produced by the presence of the diseased tissues. Such cases which begin in the synovial tissues are decidedly strumous, belonging to the form of that diathesis with fine connective tissues, and run their course more rapidly than the ordinary pulpy disease of synovial membrane. The new tissues are not long persistent; in from six to twelve weeks pus forms in and around the joint, and makes exit by tolerably straight simple passages; the cartilage disappears rather quickly, leaving generally the articular lamella attached; if a probe be passed into the sinus it finds bare bone all round; the cancelli inflame; their lining membrane does not granulate freely, but abscesses form among certain of the cavities and open into the joint by sharp-edged singular looking holes in the otherwise even bone-surface. The periosteum becomes inflamed and swollen, generally suddenly; the patient complains of pain, and the surgeon finds a deep hard swelling beneath the muscles, equally diffused all round the bone. This tumefaction may subside and recur three or four times, but each time it does so it leaves more and more persistent enlargement behind it. At last, if operative interference be still postponed, abscesses form, both in and around the periosteum; caries (generally caries necrotica) commences in the end of the bone, and spreads even a long way from the original seat of disease. Such local disorder is always accompanied by a corresponding fever and depression in health, so that in such cases the joint can hardly be saved.

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[1] A remarkable case of rheumatic synovitis was detailed, p. 183, showing that such a malady might advance to a point permitting dislocation without production of abscess or other impoverishing process.

[2] The nature of our present subject postulates far-advanced cases.

There is in all diseases so close a relationship between local manifestation and constitutional condition that it is barely possible, and certainly not judicious, to consider the former without reference to the latter. In a few cases of even very far advanced joint-disease the constitution will remain so little affected that the surgeon may rightly postpone operative interference, hoping that yet a change for the better will, as sometimes occurs, set in. On the other hand, when the general health is plainly suffering, when a strumous patient manifests even the first signs of hectic, there should be no hesitation, because this state is one which especially favors, or causes tuberculization of internal organs.

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[1] The remarkable change for the better in general health, the sudden tendency of the abscesses to heal, and the remission of pain upon the occurrence of dislocation, have been already noticed as showing the influence of inter-articular pressure.

B.—*On Amputation and Excision performed for the Removal of Diseased Joints, and the Causes of Preference for one or the other.*—It is not very many years since that, whenever it was deemed necessary to remove a diseased joint, the limb was amputated;[1] but, about a century ago, a change in this respect began, and the possibility of removing the diseased portion, without sacrificing the entire limb, came into consideration. The first notice of any case of removing a portion, or the whole, of a diseased joint that I can anywhere find is reported by John Daniel Schlichting, M. D., in 1742; the surgeon who performed the operation, and whose name the doctor does not think it worth while to give, extracted the head of the thigh-bone in a case of hip-joint disease.[2] It is probable, however, that the head was separated at the epiphysis, as no mention of the use of a saw is made. No deduction is drawn as to the repetition of this operation on the same or other joints.

In 1768, Mr. White, of Manchester, removed the head of the humerus for caries;[3] subsequently four inches of the end of the humerus exfoliated, yet there was only an inch of shortening, which Mr. White attributed to the weight of the limb dragging it down, as "it was only suspended by a common sling, and the patient not at all confined to his bed."

In January, 1774, Mr. Bent, of Newcastle, published[4] the case of a woman from whom, in 1771, he had removed the head of the humerus for caries. The patient walked away from the surgeon's house to her lodgings, and appears to have worn no apparatus except a sling.

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[1] The shoulder and hip must be excepted.

[2] The case is thus reported under the title "*Coxæ articuli suppuratio cum secessione coxæ femoris solidata.*—Anno 1730.—Puella rustica, ætat. 14 annorum, coxæ articulus tumescit, dolet, suppuratur, perumpitur. Chirurgus dilatat foramen naturâ factum, extrahit totum ossis femoris caput. Subjecit posthâc in ulceris cavitatum *Myrrhæ tincturum* porro *fuscum Ung. fel W.* stringat eam, denique arcto vinculo raro deligat, atque sex septimanarum curriculo consolidat, ut puellam post-modum libere liceat manca inseperit."—*Philosophical Transactions*, vol. xlii. p. 274. Here follows a rough diagram of the head and neck of a thigh-bone which gives no further information about the case.

[3] Phil. Trans., 1769, vol. lix. p. 39, and Cases of Surgery, p. 57. I put this case before another, because it was first published.

[4] Phil. Trans., vol. lxiv. p. 353.

In October, 1778, Mr. Orred, of Chester, read before the Royal Society[1] a case in which he had removed the carious head of a humerus with success.

These are the first recorded cases of resection of the joint extremities of bones, or decapitatio ossium, that I can anywhere find. M. Velpeau, indeed, in his *Médecine Opératoire*, vol. ii. p. 703, remarks, that in 1740 Thomas of Pezenas had successfully extracted the head of the humerus. Guthrie[2] relates this case. The surgeon had enlarged the opening into an abscess; two or three days afterwards the necrosed end of the bone presented at the wound. About that time several French surgeons[3] make mention of extracting the splinters of the caput humeri, shattered by musket balls; but such operation is merely removal of splinters through a wound already existing, and does not therefore come into our subject. We may claim for England the first idea of the operation for removing the heads of bone; but the reader will observe, that the cases above given are not excisions of joints, for only one of the bones entering into the articulation was sawn through, and only one of the joint-surfaces removed: the cases belong to the category of partial resections, or, more definitely, to decapitations of bone (Decapitatio ossium).

We may also claim for England the first total resection of a joint, or removal of all the bones entering into its composition. The first published case belongs to Mr. Park, of Liverpool, and the operation was on the knee-joint. It was performed on the 2d July, 1781, and was, as all the world knows, perfectly successful, the man afterwards following his occupation as a sailor. It appears that Mr. Filkin, of Northwick, had actually the priority of Mr. Park, having operated on a knee-joint on the 23d August, 1762, with such success that by the 21st of November the patient was so well as to need no further attention. He was alive in 1783, and the operator's son proposed that he should call on Mr. Park. In the pamphlet which Mr. Park published on his cases, he proposes this operation for the elbow, and Mr. Justamonde, taking the hint, performed a partial resection of that joint. At this point the operation was taken up in France by M. Moreau, de Bar-sur-Ornain, who, between the years 1786 and 1798, excised the shoulder, elbow, knee, ankle, and tarsal joints. Thus, at the beginning of the present century, the possibility of taking out a joint and saving the rest of the limb was firmly established, and the practice has continued in different countries with a variable and fluctuating vitality ever since. On the Continent, both in Germany and in France, many operations of this sort were performed. Textor, Muller, Jäger, Roux, and others, had successful cases; but in England the practice fell into disuse, so that Sir P. Crampton's operation in 1822, and Mr. White's, of the Westminster Hospital, case of removing the head of the thigh-bone, was quite a revival of the method. The present generation of British surgeons is indebted to Mr. Syme for the last revival of excision of joints, and to Mr. Fergusson for its present extension, particularly to the larger and more important articulations.

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[1] Phil. Trans., vol. lxiv. p. 6.

[2] On Gunshot Wounds, p. 473.

[3] Boucher, "Observations sur les Plaies d'Armes à-feu," Mémoirs de l'Académie de Chirurgie, t. ii. MDCCLXIX. p. 287.

For the last ten years these operations have been at a premium, and, no doubt, several fluctuations will yet occur before their actual value is definitively fixed. The value varies for different joints, and must be the subject of ensuing sections of the present chapter.

Each extremity possesses three large joints, the first uniting it to the trunk (the scapula being reckoned therewith), the second in the middle, the third near the end of the limb. Amputation performed at the first joint removes the whole extremity, and proportionally less for the second and third; hence is more objectionable the higher the joint which it is intended to remove. Moreover, amputation at the first joint does not take away the whole of the disease unless a portion, more or less, of the bone of the trunk be taken with it. Amputation at the shoulder is a somewhat dangerous, at the hip an almost invariably fatal, proceeding; hence such operations have, I believe, seldom, and certainly ought very rarely, or never to be performed for articular disease. The other joints are differently placed, and the surgeon must choose which of the two operations he may deem most conducive to his patient's benefit. There is no doubt as to which he would select, if he could be certain that while exposing life to no greater danger, he could, by the one, secure to his patient a useful limb which by the other proceeding would be sacrificed; but both points are doubtful: excision may produce greater risk, and the limb retained may be useless; the chances vary in each joint, and must be considered hereafter.

The general objections to amputation are—the risk to which the patient's life is exposed by the operation, for all amputations have a certain mortality, which, *cæteris paribus,* varies according to the proximity to the trunk at which the operation is performed; or, perhaps, we might be nearer the truth by saying, according to the amount removed—thus, amputations at the thigh expose to greater danger, the higher the point at which the limb is cut off, and are more fatal than amputations below the knee—more dangerous than removal of the upper, which, again, is more dangerous than ablation of the forearm. The immediate dangers are from erysipelas, purulent infection, or the other sequelæ which are common to all operations; but these may be increased by the severance of large vessels and nerves, which has of itself a peculiar depressing effect upon the system, and by the large loss of blood which sometimes attends such operations. Sometimes, moreover, patients sink after amputation without any obvious cause, and such effects may be attributable to the sudden removal of a large portion of the patient's body, together with a great quantity of his blood—all that the limb contained besides that actually effused. "It is also observed that patients who have suffered amputation for caries often fall into bad health, and die of dropsy, or some other chronic complaint, within a year or two after the operation. These bad effects seem referable, with most probability, to the disturbance, which is excited in the system by taking away a considerable portion of the body; but whatever may be the true explanation of them, there can be no doubt as to the fact of their occurrence, which ought to be carefully remembered in making the comparison which is now attempted."[1] The last objection to amputation is the inconvenience which the loss of a member entails; an inconvenience which varies in each limb, according to the height at which the operation has been performed.

The advantages which are claimed for amputation of diseased joints are its safety beyond excision; the celerity with which the patient gets well; the utter removal of the disease, which gives no further trouble. Of the safety of amputation something may be inferred from what we have said of its dangers; statistical accounts for each amputation, as performed for joint disease, will be hereafter given. A patient who has suffered excision of a joint, particularly in the lower limb, must be, as a rule, kept in bed longer than one who has undergone amputation; but it may well be doubted, as Mr. Butcher[1] has observed, whether he is able to bear the application of an instrument either to upper or lower extremity earlier than he would have been restored to use of the limb had it not been amputated. The utter and entire removal of the disease, which then ceases to give any trouble, is doubtless an advantage; but is it so constant a result as is frequently affirmed, that amputation of a limb saves all further annoyance, except merely that of its absence? We find in hospital a good many cases of conical stump, even after an apparently good operation; there are also cases of painful stump, not conical, which appear to depend, as Mr. Hancock has shown, on a junction by some tough material between the nerve and the end of the bone.[2] In the beginning of 1860 a man was in Charing-Cross Hospital, under Mr. Hancock's care, who had twice been amputated at the thigh, and died after amputation at the hip had been performed by that surgeon as a last resource to save the fragile life.

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[1] Syme "On Excision of Diseased Joints," p. 16.

The disadvantages urged against excision are: 1. Its greater danger than amputation. 2. The length of time required for cure. 3. The improbability of the limb being otherwise than an encumbrance. 4. The difficulty of selecting such cases as shall be not only saved, but have useful limbs. 5. The difficulty of the operation.

1. It is questionable whether the operation of excision, under its most favorable circumstances, be really more dangerous than that of amputation, also under the best advantages: it is a doubt which can only be answered by statistic records, and such must be given as far as they can be gathered. Now, the mortality of amputations varies, like that of excisions, with the place at which the operation is performed, and comparative statistics must be given when the operation at each joint is mentioned. It has lately been the fashion in Germany to deal much in large statistic numbers gathered from all sources, and I find in Dr. Paul's work[3] a long table of all cases

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[1] Dublin Quarterly Review, 1854.

[2] See Hancock "On Painful Stump and on an Operation for its Cure," Lancet, vol. i., 1859.

[3] "Conservative Chirurgie der Glieder," p. 18 et seq.

collected from German, French, and English publications, from 1790 downwards, including military, naval, and civil surgery. This mode of gathering statistic numbers is not very reliable, but still the truth is approximately told, and may be corrected by more selective work. Paul gets together 8315 cases of amputation, including even fingers and toes; of this total number, 2622 die—that is, 100 in every 317. I have eliminated from this table all the more insignificant amputations, and leave only the six more severe ones;[1] of these, there are 2533 cases, with 976 deaths—that is, of every 258 cases, 100 die, or as near as possible, two in five. It is, however, to be remembered that amputations for chronic disease are somewhat less fatal than for injury or acute disease. Malgaigne, who takes his statistics from the Hôtel-Dieu, a very lethal hospital, says that, of amputations for injury three-fourths die; for chronic disease, three-fifths. The number of deaths in amputations for joint-disease in St. Thomas's Hospital may be gathered from a table in South's Chelius,[2] which records nineteen amputations of the thigh for knee-joint disease, whereof four died; one of those to whom the operation proved fatal, who lived longest, only survived three months—that is, twenty-one per cent. of these cases proved fatal.

We may here be permitted to adduce the *à priori* reasons for believing that excision ought not to be a more fatal operation than amputation. The wound, in most cases of excision, is actually smaller, *i. e.*, the superficies of cut surface is less than after amputation at the same place;[3] moreover, by far the larger proportions of such surfaces are brought again into contact with the parts wherewith they were formerly in continuity, and there is, in my mind, no doubt whatever that healing takes place more readily under such circumstances, than when the wounded parts are brought into relation with strange surfaces. The large vessels and nerves of the limb are not implicated; no large portion of the body, solid or fluid, is removed; there is very insignificant bleeding, hence the shock should be less than after amputation,[4] and, therefore, the immediate danger less. The amount of more remote danger depends very much upon the after-treatment, the duration of the confinement, and some other circumstances; but it is probably less than in amputation, since it is not open to that source of danger which Mr. Syme points out in the passage above quoted. 2. The length of time required for cure is no doubt an objection, more particularly if the joint be of the lower extremity; for the long confinement to bed, before it is safe to place any weight upon the limb, or even to allow it any movement, is, to say the least, tedious, and may be detrimental. This objection vanishes, however, when the joints of the upper extremity are the subjects of operation. 3. Whether the limb will, or will not, ever form a useful extremity depends much upon the after-treatment, and the mechanical ingenuity of the attendant; and again upon the situation of the joint, and the sort of union required. We know that at the knee, where it is generally desirable that the union should be inflexible, there is greater difficulty of obtaining a useful limb than in other articulations of the body, where the results of the operation are generally satisfactory; but the statistics of operation for each joint will show the number of cases wherein the limb saved has been a useless incumbrance. 4. The difficulty of selecting cases that are likely to do well after excision has been somewhat exaggerated, or misunderstood, by some writers. The question can here only be considered in its general bearing, since it must be touched upon in each special instance, as it comes under notice; it is evident that two points are concerned in this inquiry—the constitutional and the local condition. If it be true that excision of a joint is a less severe injury than amputation above the articulation, it would seem, at first sight, that no state of health which might permit the latter could forbid the former procedure. Such deduction is true for the immediate effects of the operation; but if the process of cure be one (this depends upon the especial joint in question) which necessitates a long confinement to bed, other considerations are involved. We have seen that a gradual yielding to the wear and tear of an articular malady produces a state of hectic more or less acute or chronic. Now, there are certain conditions more easily to be recognized at the bedside than to be described in print, which lead the surgeon to judge whether the health is being destroyed by the pains and exhaustion of the disease, by the confinement, or from internal and more general causes; while the joint affection acts only as an additional, not as a primary cause, of the constitutional disturbance. Among the signs whereby the surgeon may arrive at this conclusion, is that the severe pain, occurring, as is usual, chiefly at night, is followed in the course of the day by a greater rebound from the morning's exhaustion than can be accounted for by the mere remittent character of hectic; also, he, having watched his patient pretty closely, may observe that at some very uncertain times, ameliorations occur in the amount of such pain, and that they are followed by an immediate, almost instantaneous improvement, in the patient's condition; there is, in fact, a *resiliency* in the constitution which promises well for its recovery when the irritating cause is removed. Chiefly there must be a total absence of disease in any internal organ, the stomach being fairly able to digest healthily, the mesentery free of tubercle, the lungs untouched by phthisical disease, the kidneys secreting healthy urine, the liver and spleen of normal size.

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[1] Amputation of the upper arm and thigh at their joint and in their course; of the forearm and leg.

[2] The total number of amputations is 28, of which 10 died. (Chelius's "Surgery," translated by South.)

[3] Butcher, loc. cit., adduces this reason.

[4] I cannot consider that cutting into a disorganized joint can produce a shock as though it were sound, and many examples prove the contrary.

The local conditions which forbid resection, may be situated either in the soft or the hard parts, or both. It may be doubted from the results of some cases that have done well, whether there be any condition of soft parts which would utterly preclude excision of a joint. Certainly, cases of the so-called gelatinous condition of synovial membrane have done extremely well, when the joint was removed; although a few have been less successful, the limb having been afterwards amputated, on account of recurring exuberance of such growth.[1] Abscesses in the soft parts, even extending a long way from the original disease, do not of necessity contra-indicate excision, as a case which occurred among Mr. Hancock's patients at the Charing-Cross Hospital is sufficient to prove. (See p. 453.) Few surgeons, however, would choose excision of the joint, in preference to amputation, if the limb above and below the seat of disease had become a mere bag of matter. Thus, the question of amount of disease among the soft parts, which shall forbid excision, becomes a question of degree, to be judged by comparing the amount of repair necessary for the consolidation of the abscesses with the patient's health.[2]

The state of the bone is a point of greater gravity, but it is one which cannot, in a large number of cases, be determined until, not merely their surface, but their cancellar structure is exposed, when the surgeon, having commenced his operation as for excision, may, if he see fit, conclude it by amputation. In a preceding chapter,[1] an account was given of the appearances assumed by the cancellous structure of bone, under the influence of a strumous osteitis, and the distinction between a diffuse and a circumscribed inflammation was insisted upon, as the result of a marked difference, in the amount of constitutional cachexia, whereby the disease was produced. For our present purpose, it is of no importance whether the disease commenced in the synovial membrane or in the hard parts; we now have only to do with the appearances of the bone-section. These may deviate from the norm by hyperæmia, extravasation, granulation, suppuration, and by wasting, or induration of the cancellar walls. This last appearance is, in all instances, favorable to excision, in direct proportion to the amount of tissue thus affected, in contrast to the amount which has undergone softening; it is a sign of a constitution capable of a sthenic inflammation; such condition is very rarely spread over the whole section surface, and then only in the rheumatic form of inflammation. In strumous cases, induration of the bone tissue, when present, alternates with softened portions, and the more of the thickened tissue be found upon section, the more favorable is the case. Other appearances, hyperæmia, granulation, suppuration and wasting of the cancellar walls, will all be present in cases of strumous disease so far advanced as to justify operative interference; none of these should of themselves militate against completing the excision; but if they be diffused over the whole, or nearly the whole section, be hardly at all intermingled with indurated portions, and not confined to one or two spots surrounded by thickened osseous tissue, it will be better to amputate the limb. Extravasations in a few small specks do not, but large blotches of extravasated blood should forbid excision. Tuberculous matter, when present, is a decisive call for amputation; but we have already questioned, if the material which in bone is often called tubercle be in reality that morbid tissue, although we cannot deny that such may in a few rare cases exist. Mr. P. C. Price, in an excellent pamphlet on Excision of the Knee

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[1] It has already been questioned whether an articulation should be removed simply on account of such condition: the results of my experience would decidedly negative any such necessity.

[2] Malignant diseases are altogether excluded from consideration.

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[1] Chapter XI. p. 225 et seq.

Joint,[1] has justly insisted upon the distinction between a diffuse and circumscribed condition of the inflammatory products; but hardly, according to my views, with a due knowledge of the material whereof he speaks, nor of the pathological grounds for his in general very just conclusions. The material in the cancelli, which he describes, is not an infiltration, but is granulation from the membrane lining the cancellar cavities. A diffuse inflammation, wherever it be situated, and whatever be its products, always marks so low a constitutional state, that we should give the system as little reparative labor as possible; the granulation produced by such an inflammatory act will hardly form the sound tissue so essential to success in these cases, but will greatly tend to the degenerative processes. The more straw-colored be this tissue, the less should we trust to its organizing force. Again, if the section surface be throughout of a dirty yellow, from diffuse suppuration, and the cancellar walls be all softened, impressible with the finger, or incisable with the knife, amputation should be at once employed.

If such appearances be limited to circumscribed portions of the section surface, there is still a further investigation to be made, namely, the depth to which the softening extends. Unless the superficies of such a portion be very soft, it is hardly likely to extend far; the gouge, or Mr. Marshall's osteotrite, may be used, and the diseased portions removed; but if they run a long way into the bone, more especially if, as sometimes happens, the several spots unite, and form a large space of softened tissue some way from the surface, the case is not suitable for excision. Again, if there be a sinus-like hollow, only filled by granulation tissue, running far into the osseous structure,[2] in such way that removal of the surrounding carious bone leaves a large cavity, the limb had better be amputated. The patient may do well, and even get about, but I have had occasion to observe, that abscess in the bone is afterwards produced. In one case of this sort, the man has told me that he suffers so much at different times, as often to wish his leg had been removed. It may be well to place in a succinct form the conditions which do not, and those which do, contraindicate excision of a joint.

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[1] "Surgery of Diseased Joints, with especial Reference to the Operation of Excision." No. I.—The Knee.

[2] The meaning of the word *far*, varying for each joint and bone, must be left to the judgment of the operator.

CONDITIONS UNFAVORABLE TO EXCISION OF A JOINT.	CONDITIONS FAVORABLE TO EXCISION OF A JOINT.
General.	
Coexistence of any internal organic disease, chiefly tubercles of the lung or mesentery. Albuminuria, enlargement of the liver or spleen, simultaneous affection of any other important joint or of the spine.	Absence of all internal disease; simultaneous affection of other important joints, or of the spine.
Apparent dependence of hectic fever upon some cause other than the local disease.	Dependence of hectic fever solely upon local disease.
Local Condition of the Soft Parts.	
Abscesses extending a very great way from the original seat of disease.[1]	Restriction of morbid change to a locality not far from the original seat of disease.[1]
The more acute be the suppuration, the less favorable is the case.	The more chronic be the suppuration, the more favorable is the case.
Local State of the Bone.	
Prior to commencement of operation.—External caries or suppuration of the periosteum spreading to a considerable distance from the joint-end; whether this be primary or produced by spreading of the inflammation.	*Prior to commencement of operation.*—Restriction of morbid action to a locality not far removed from the joint end.
After removal of a slice of bone.—Presence of extravasations, particularly if multiple and in large blotches.	*After removal of a slice of bone.*—Absence of extravasations, or their appearance only in a few small spots.
Diffusiveness of inflammation, more particularly if it be suppurative.	Circumscription of the inflammation, whether suppurative or no.
Absence of all bony thickening; presence of diffuse softening.	Presence of bony thickening, more particularly if it be not scattered, but circumscribe softening, or other low form of inflammation that may affect the bone.
Softening of the whole, or nearly the whole, surface section, particularly if combined with diffuse suppuration, or if the granulation tissue be straw-colored or greenish.	Absence of great amount of softening, or suppuration; florid, healthy granulations, circumscribed by indurated tissue.
Long sinuses running up the bone containing pus, or softened osseous tissue.	Absence of any long sinuses running into the bony structure.

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[1] This indication, or contraindication, is but a question of degree; for instance, abscesses down the thigh, in hip-joint disease, do not of themselves forbid excision of the head of the bone. The amount of repair necessary must be contrasted with the amount of vigor still remaining.

5. There remains only the last of the objections which have been urged against excision, namely, the difficulty of the operation. This, at the present day, will hardly have weight; the surgeon has no right to substitute for an arduous operation an easier one, which may be less advantageous to his patient. Moreover, the difficulty of excision is not sufficiently greater than that of amputation, to deserve consideration; indeed, the operations are far from difficult. Excision of joints occupies just now a good deal of attention; the *éclat* of turning out a patient walking about with no knee or hip is so much greater than that of simply curing the disease, and the far less inconvenience produced than by amputation, may render the surgeon less prone to hesitate on inflicting the mutilation, and thus it is to be feared a good many may be subjected to the operation whose joints ought to be saved.

The various circumstances now detailed having been duly weighed one against the other, the surgeon will make up his mind according to the balance of facts. If he be led to amputate, the joint-disease, indeed all circumstances having special reference to the present subject, are done away with; the patient will recover or not, according to his bodily powers, and will constitute one of the items, on either side, in the statistics of the particular operation. But if the surgeon excise the joint, many circumstances are of great interest for our subject, and we will examine them accordingly.

C.—*On some Points to be generally observed in Excising Joints.*—Repetition will be avoided if a few points, to be observed in the excision of all joints, be insisted upon before considering special cases. In the first place, the operation should always be so performed as to do as little injury as possible to the soft parts, and so as to avoid any important nerve or vessel. The incisions should always[1] be so devised that some part of the external wound is depending, allowing a free exit for pus; so important in my mind is this condition, that ease of operation, or even small size of incision, may be readily sacrificed for a *depending opening.*

The epiphysal ends of bones are in early life separated from the shaft by a line of cartilage, an arrangement which permits growth in length by the constant addition of fresh bone to the end of the diaphysis. It is evident from this fact, that if in a person who has not yet attained full vigor, the epiphysal end and cartilage be altogether removed, the bone ceases to grow; hence, the younger and smaller the child upon whom we have to operate, the more care must be used not to cut off this portion. It will subsequently be mentioned, with regard to two joints, that in one the epiphysis is less, in the other more, important than elsewhere; but, except in those cases, mention of this fact will not be made.

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[1] Civil surgery has generally the choice of locality in making incisions; in military surgery the knife must frequently be guided by the bullet.

It is of the greatest importance that, after a resection, particularly of a large joint, the limb should be adjusted with as little irritation to the patient as possible, not merely for the sake of saving pain, although that is by no means a minor point, but in order that the limb may be adjusted at all. In some parts this is of less consequence, in others more; but in all it is sufficiently important to deserve the strictest attention, and, in the knee more especially, may make all the difference between life and death.

D.—*On the Reparative Process after Resection.*—It is not necessary to linger long over this part of our subject, because the minute differences in the various modes of repair are of but little practical importance, and because Wagner's exhaustive treatise on the subject, having been carefully translated by Mr. T. Holmes for the New Sydenham Society, is within reach of all. The experiments upon animals made by Wagner, and the number of cases of post-mortem examination which the author has collected, and which has been admirably completed by Mr. Holmes, give plentiful examples of the local conditions after excision. Immediately after the operation, there is set up an inflammation, which causes all the parts around to swell.[1] In a certain time, which varies from two to five days, pus begins to form, and at the same time granulations arise. In cases where the spongy texture of bone is cut through, as in resections of large joints is always the case, those growths arise probably as early from the cancelli as from the soft parts surrounding the bone. At least, in one case in which I had an opportunity of examining the condition of a small portion of surface a few days after excision, I found it covered with small florid, velvety granulations. The result of this action, both in hard and soft parts, is the following: the ends of the bone become inclosed in a bag of granulations, which separate them from surrounding parts, and act as a bond of union between them.[1] When the osseous extremities lie close together, the granulations which spring from them occupy the narrow space. When there is a more appreciable interval between the sawn surfaces, those growths often do not sprout quickly enough to fill up the cavity. Those from the soft parts being more luxuriant, take upon themselves that duty, and thus the bag forms within itself a partition, which divides it into two portions, each containing a fragment of the bone.

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[1] The great extravasations of blood, and the distension of tissues which Wagner describes as a phenomenon always present in animals, whether bones be resected or merely broken, is not either a necessary or a frequent sequela of resection in the human subject.

In the first case, the granulations from the cut end of the bone may unite, forming at first a soft bond, which may become fibrous, and ultimately osseous. Even the inner layers of the surrounding granulations, having become united to the periosteum, may ossify, forming a provisional callus. Or the new growths from the bone cancelli may not have the power to produce new tissue; the bones will not unite; but their ends are gradually rounded off. The capsule produced by the granulation from the soft parts becomes fibrous, and thus a false joint is formed, the ends of the bone becoming polished by attrition, when movement is allowed; or if cachexia remain, they may again yield to caries.

In the latter case, that in which the granulating bag of the soft parts sends a process between the bones, this partition may become united to the granulations from the cancelli. Thus, also, a fibrous junction is formed; but under those circumstances the bond of union hardly becomes ossified. More usually, the new tissue from the bones does not unite with this interposed material, but, while the osseous ends become rounded off, that production assumes a fibrous, and, when motion is allowed, even a fibro-cartilaginous structure. By this means a condition is produced, most frequently met with at the shoulder, wherein each bone is inclosed in a separate cavity, being bound together by the circumference, and separated from each other by the partition in the bag. The whole is comparable to the joint of the jaw, wherein the bone-surfaces are separated by a fibro-cartilaginous meniscus.

In all cases, when a pseudo-arthrosis is formed, the inside of the bag becomes lined by pavement epithelium, secreting a glairy, synovial-like fluid; but synovial fringes, or villi, seem not to be produced. Sometimes, in such instances, the extremities of the bones become covered by an ill-developed cartilage. When the osseous ends at the shoulder-joint are separated from each other by a considerable interval, it may happen that a thin styloid process is developed from the humerus to articulate with the glenoid cavity, which in all the cases in which this arrangement has been found was not cut away.

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[1] This inclosure of the ends of bone by a membranous bag must not be considered as an action peculiar to either fracture or resection (for it occurs in both); it simply results from irritation of the surrounding parts by the ends of the bone or by surgical disturbance, and is analogous to the encysting of a bullet or other foreign substance.

It follows from these facts that, in order to secure a firm union, the extremities of the bones should be kept close (not pressing) together. If this union is not to be bony, passive motion must after a time, depending on the more or less tough bond already formed, be instituted. Perfect immobility must be enforced, if osseous union is to result. If, on the other hand, free mobility, rather than strength of the new joint, be desired (as at the shoulder) the osseous extremities need not be kept very close together.

E.—*On Resection of Special Joints. The Shoulder.*—There are not many cases on record in which the whole shoulder-joint has been resected; simple decapitation of the humerus being a much more common operation; but there is no difficulty, when the head of that bone has been removed, in gouging away any portions of diseased structure from the glenoid cavity, or indeed in cutting off the whole articular process with bone nippers; such little addition hardly complicates the procedure. The statistics of this operation are very favorable. Paul collects 84 cases, of which 23 die; we may add to these, 27 cases in the Crimean war, with 2 deaths; making altogether a number of 111, with 25, *i. e.*, 22.5 per cent. of deaths. Amputation at the shoulder-joint produces deaths at the rate of 27 in 66, or 40.8 per cent. Disease of the shoulder-joint, requiring excision, is rare. Mr. Syme gives two cases: one is reported in the *Med.-Chir. Trans.* for 1858–9, under the care of Mr. Birkett; another, in the same work, in which Mr. Jones, of Jersey, removed the head of the humerus and a large portion of the scapula; but the larger proportion of the above number is made up from the records of military surgery, which is carried out under conditions far less favorable to the patient than civil practice, and furnishes, therefore, less favorable views of the resection. It is said that anchylosis never takes place after decapitation of the humerus, with or without removal of the glenoid cavity. We certainly find no record of such result in Wagner's work,[1] nor in the appendix added by Mr. Holmes to his translation. All the limbs saved retain a great amount of mobility and usefulness; in some cases so much so that one would hardly imagine that the joint had been cut out; but in one case Lentin removed the whole humerus except two inches of the lower end, and Jäger[2] mentions that the arm remained stiff. It is a point not always easy of diagnosis, for the glenoid cavity acquires such a degree of mobility that even were anchylosis to take place the arm would be by no means fixed. To the modes of union we shall have more particularly to refer in the sequel.

The method of operation has undergone various changes since White removed the head of the bone by means of a single longitudinal incision. Moreau[3] made use of an old incision in front of the joint, drew another at the back, united them above by a third, and turned down the quadrilateral flap. Such a method exposes the joint much more, and makes a larger wound than necessary. Syme[4] proposes a longitudinal incision from the acromion on the outer side through the middle of the biceps to its insertion, and another from the lower end of this backward and upward to the posterior border of the axilla. Liston proposes "an incision three inches long, running from the point of the acromion through and near to the insertion of the deltoid, or what is much better, may course along the posterior border of that muscle. More room is gained for the completion of this operation by making an incision from the front of the acromion three inches down the arm across the chest, and raising the elbow, the head of the humerus protruded and examined, and so much as is in an unsound condition taken away with the saw."[5] Langenbeck operated by means of a deep cut in front of the joint, running from the acromion process downwards. He then released the tendon of the biceps from its groove and turned it inwards; by rotating the humerus first outward, then inwards, the capsular muscles were brought into view and divided; then the elbow being thrown back caused the head of the bone to protrude at the wound. This operation is not only easy but artistic in all its steps: it has however this damnatory fault, that it allows no outfall for pus. Stromeyer adopted another mode of incising the integuments; beginning at the outer and back part of the acromion, he makes a semilunar cut with the concavity forwards, opening the joint above and behind; the rounded flap being lifted and the arm rotated outwards, the biceps tendon can be turned out of its groove inwards and preserved. This operation is easy and affords the best chance of a rapid recovery; it is only advisable to add that the first cut should expose the joint and should begin *on the top* of the acromion.

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[1] "Ueber die Heilungs-prozess nach Resection und Extirpation der Knochen."
[2] "Rust's Handbuch," art. Decapitatio, p. 609.
[3] "Observations Pratiques relatives à la Resection des Articulations," &c., p. 80.
[4] "On Excision of Diseased Joints," p. 50.
[5] "Practical Surgery," p. 159.

It certainly is desirable in every operation to save all parts whose severance is not necessary, but it may be remarked that division of the long head of the biceps does not seem to produce any diminution of power. In three cases by Esmarsch[1] this tendon had been divided by the bullet: perfect use of the muscle was restored. Moreover, an advanced disease of the shoulder joint generally involves all the capsular part of the tendon in the inflammation, and destroys it. If the glenoid process be cut off the attachment of the long bicipital head must go with it.[2]

An effect of this operation, which seems inevitable, is shrivelling of the deltoid: it has been attributed to division of the posterior circumflex humeri nerve. I cannot but think that in many, though not perhaps in all cases of excision for joint-disease, this may be avoided; in the dead subject it certainly need not be divided, but, being readily seen as it courses round the neck of the humerus, may be turned down by a probe or forceps, a few fibrous bonds being touched with the knife.

The skin may be sewn together through the chief length of the cut; but the most depending portion should be left open to favor the flow of pus. The arm should be bound to the side as a matter of precaution before the patient leaves the theatre. When put to bed the limb is to be placed on a cushion, which lifts the elbow from the bed to a height equal to that of the body, and which at the same time is bent so as to separate the arm from the side; a fold of linen, fastened to the cushion on each side of the arm, and passing over the limb, serves as a sufficient splint; the elbow is to be bent at right angles, the hand to be lightly secured over the lower part of the chest.

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[1] "Ueber Resectionen nach Schusswunden."

[2] In Germany the surgeons use the hot iron a good deal to carious parts, with the idea of changing the morbid action; or, as Blasius ("Beiträge zur Praktischen Chirurgie," p. 60) says, with reference to a diseased part of the glenoid cavity, "to change its peculiarity as a joint surface." I have never used this means, nor seen it used in England, but it may well be that a merely superficial caries will put on more healthy action after contact with the cautery; the slough, however, must be thrown off, a process which may be saved by judicious use of the gouge.

No great amount of fever or other evil condition follows this operation; in from ten days to three weeks (the absence of untoward circumstances being assumed) the patient may be allowed to get up with no other protection than a well-secured sling.

The Elbow Joint has been partially and totally resected. The surgeon may, after injury, frequently have a choice as to which mode he will adopt, but in joint-disease seldom, if ever. Certainly it would not be wise to run the great risk of return of caries for the mere sake of saving a portion of joint-surface which would after all be useless. Indeed, it is said, that anchylosis follows more certainly when a portion, than when the whole joint is removed. This result seems contrary to what we should expect, but Stromeyer[1] and Esmarsch[2] appear quite certain that this was the result of their experience in the Schleswig-Holstein war, and the former ordered that no total resection of the elbow should take place unless necessitated by the injury, because, as he says, "he desired to retain no useless limbs."[3]

Some other points, however, here come into consideration, namely, the length of time between receipt of injury and operation, the absence or presence of ice, &c. &c. In fact, it seems that to secure a flexible joint, inflammation should be kept down as much as possible.

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[1] "Maximen der Kriegsheilkunst," p. 92.

[2] "Ueber Resectionen nach Schusswunden," p. 90.

[3] As regards excision performed for joint-disease, this point has not so great weight; but as a matter of collateral interest we may give the results of cases during the Schleswig-Holstein war as gathered by Esmarsch, and quoted in an abbreviated form in the last edition of Stromeyer's work, although I cannot see that they bear out his conclusion. In 7 total resections occurred: synostosis, 3 times; partial mobility, 3 times; great mobility, 1 time. In 23 partial resections: synostosis, 10 times; partial mobility, 7; great mobility, 6. That is to say, that synostosis occurs in total resections 42.85 per cent., in partial 43.47; a difference hardly warranting any forcible conclusion. Some mobility is found in 42.85 per cent. of total, in 30.43 per cent. of partial; great mobility in 14 28 per cent. of total, in 26.09 per cent. of partial resections. A result rather tending to show that mobility results in an equal number of cases after either operation, and that partial excision is followed by considerable power of motion.

The proportion of deaths in these cases is extremely small. Paul[1] gives in 115 cases, 25 deaths; Macleod[2] cites 20 cases with 7 deaths (4 of these are said to be from causes unconnected with the operation, but I shall count them with the fatal cases). Mr. Erichsen[3] says that he has performed the operation ten times with but one death; to these cases I can add four with no death (none of these are included in Paul's list). Thus we sum up 149 cases, with 33 deaths, or 22.15 per cent. Amputation at the humerus yields 157 deaths in 470, or 33.4 per cent. In some few cases, whose proportion cannot be fairly estimated, but which is, however, very small, the limb left is useless—in general a tolerably, in many instances an extremely useful, arm is left. The uselessness may be caused by utter want of any union, partial uselessness by synostosis.

Mr. Syme claims, with perfect justice, the introduction of this operation into England. Mr. Park had practised it on the dead, but never on the living subject. Moreau père et fils performed it several times, and with admirable success. Mr. Syme's excision was performed in 1828. The patient does not seem to have been a good subject for operation, and did not gain much command over the elbow—but "he was able to use it," says Mr. Syme, "in giving instructions in arithmetic, &c."[4] Other cases of the same surgeon were more completely successful.

The modes of operation are several: the surgeon should not limit himself to one, but be ready to perform any that may be necessary. The incision may be single and long, running down the outer side of the ulnar nerve. In cases where there is little tumefaction, this is sufficient; but if, as is so often the case at this joint, considerable thickening and swelling of all the surrounding parts be present, one simple long cut does not suffice; it will be desirable to carry another from this point outwards above the olecranon. Again, sinuses on the outer side, or extreme swelling of the joint, may render it more expedient to make the old H-shaped incision practised by Moreau. One of the longitudinal cuts is made just over the inner edge of the olecranon; the other between that process and the outer condyle—the two are connected together by a transverse cut just above the extremity of the ulna. In operating, the inner of the longitudinal incisions should first be made over the inner edge of the olecranon; this should be at once down to the bone; and now, before further steps are taken, a narrow flap should be turned up from the parts on the inner side of this cut. This flap should consist of the whole thickness of the material between the skin and bone, and therefore should contain the ulnar nerve, which is turned inward *en masse* with the flap, does not come into view at all, and has nothing more to do with the operation.

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[1] Loc. cit.

[2] "Surgery of the Crimean War," p. 328.

[3] "Art and Science of Surgery," p. 645.

[4] "A Treatise on Excision of the Joints," p. 76.

The other cut or cuts which are deemed necessary may now be made, and the bones cleared of soft parts. Some surgeons recommend that the olecranon process of the ulnar should then be nipped or sawn off; but, in my opinion, the best way is to dislocate the joint. In most cases of far advanced disease, this can be readily done after division of the triceps; in other instances, the internal and external ligaments must be cut. By bending the arm very much, and pressing the forearm downwards, the ends of the bone are thrust out of the wound, and, after due examination, may be cut off at the part where disease ceases. The coronoid process of the ulna, and tuberosity of the radius, should, if possible, be spared; there is no necessity for placing a spatula or other protection in front of the bones, as the soft parts, all doubled up, are away from the saw of any but an awkward operator.

The wound is to be closed by sutures, except a part on the inside of and opposite the gap between the bones; the arm placed on a splint at an angle of about 135°, or a right angle and a half; less if it can be borne—it should be disturbed as little as possible for about a week or ten days—that is, till acute inflammatory symptoms have ceased—and then passive motion should be commenced. It is in the after-treatment that the inconvenience of a transverse incision is found; for the arm cannot be put conveniently on a splint sufficiently curved, and passive motion has a greater effect in opening a transverse than a mere longitudinal wound. Supination and pronation should be particularly attended to. A true anchylosis of this joint may be excised, so as to give a better posture, and, if possible, some mobility to the arm. In doing this, it is better to cut out a wedge-shaped piece of bone, rather than simply sawing through the junction. Passive motion must be begun as soon as it is safe, in order that synostosis may not come on—an event which is much more likely to occur after excision for stiff joint than after one for still active disease. Indeed, so likely is such event to occur, that the operation should only be undertaken when the limb is fixed in a useless posture—straight, for instance—the probability of regaining a flexible joint must not be exaggerated, for it is slight.

Cases of Excision of the Elbow.

Case LXII.—Daniel Hogan, aged 30, came into the Charing-Cross Hospital, under my care, 22d May, 1860, and on the 26th of that month, I, kindly assisted by Mr. Canton, excised the elbow-joint.[1] The size of the part, and the position of sinuses, induced me to adopt the H incision. A free gush of blood followed the first cuts, but this soon diminished: the coronoid process of the ulna, the tuberosity of the radius were spared, and as little as possible removed from the humerus; owing to the gelatinous thickening of tissues, and to the presence of a transverse cut, the arm had to be put up in a straighter position than I desired.

Some secondary hemorrhage coming on, the parts had to be opened about two hours after operation, and a branch of the inferior profunda was secured.

He was ordered wine and 20 minims of laudanum.

On the sixth day he was able to sit up; the arm, from lying on the splint, had become flattened; it was ordered to be bandaged separately: a bit of the end of the radius projected above the granulations, and looked white as though it would exfoliate.

On the ninth day this part of the radius was covered with granulations, and the wound rapidly contracted. I ordered passive motion to be employed, and as there was a strong tendency to synostosis and to straightening of the arm, I constructed a splint of wire-gauze, consisting of one portion for the arm, another for the forearm, connected together by a hinge. An India-rubber spring was stretched between these, at a due amount of tension, by means of steel hooks. In a week more the arm was more flexible; he was able to take a walk, and was very much improved in health.

About the middle of July he caught a severe cold, followed by a smart fever and diarrhœa; this necessitated his being confined to bed. At the present time (August) there remain two sinuses, which have the external appearance of superficial sores; no dead bone has come away, and nothing can be felt with the probe. The fistulous passages do not seem inclined to heal, but the man has now very fair use of his arm, and it is increasing daily.

The *wrist-joint* may be excised, that is, all the carpal, the superior extremities of the metacarpal bones, the lower ends of radius and ulna may be removed; but it is very questionable whether the patient will ever be able to make use of the hand. Mr. Butcher, of Dublin, defends this operation, and gives the case of a man who preserved a sufficiently serviceable hand to earn his bread, and to write to that surgeon a very fairly penned letter of thanks.[1] Mr. Butcher's operation, by leaving the tendons of the thumb untouched, preserves the use of that member, yet the fingers remain very, if not altogether, immovable, for it is said, "No doubt after excision of the wrist-joint much motion cannot be expected; a firm fibro-ligamentous structure fills up the place of the removed bone, and fuses the surrounding textures into its dense tissue, and mats all together. But according to my views, the hand may be retained nearly as useful as ever; the fingers being kept semi-flexed during the process of repair, they retain this position, and the thumb being preserved perfect in its motions, readily approximates either of the fingers, so that the hand can be applied to the most delicate of its uses, such as writing, sewing, &c., as well as to the most severe and commonplace—using implements for husbandry, grasping bodies, &c."

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[1] The first part of this case is given in the chapter on Strumous Synovitis, p. 163.

The mode of performing the operation may be either according to Fergusson's or to Butcher's method. The former recommends an incision six inches long, extending from the distal end of the fourth metacarpal bone down the ulna. "Thus ample room may be made between the flexors and extensors, without dividing a tendon of either, to remove the whole carpal bones, and even the articular surfaces of the bones of the forearm or of the metacarpal range."[2] Mr. Butcher recommends that the incision, commencing a little to the inner side of the extensor secundi internodii pollicis tendon, should be carried in a curvilinear manner over the upper end of the metacarpus, and allowed to terminate close to the ulna. This flap being dissected up, gives ample room for extracting any diseased carpal bones, or for sawing off the ends of radius, ulna, or metacarpus.

We must not place the value of this operation very high, in spite of Mr. Butcher's successful case, in spite of the more or less success which has followed two operations by Mr. Erichsen, and one by Mr. Stanley. Mr. Butcher's excision took place on 10th August, 1855. The letter which the patient writes to Mr. Butcher, and in which he says "the hand is now quite well," is dated 1st December, 1858, three years and five months after the operation. I inquired of Mr.

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[1] "Dublin Quarterly Review," Nov. 1855, p. 174.

[2] "Practical Surgery," p. 295.

Erichsen the result of his last case, operated on 19th January, 1860.[1] With the greatest courtesy that gentleman thus replies: "The man whose wrist I excised has a useful arm and hand, at least he is quite satisfied with it, though there is some stiffness of the fingers, and at the wrist a good deal," in terms which indicate that he himself is not well pleased with the result.

Paul has been able in Germany to gather 22 cases, 6 of which are fatal. We may add 8 cases in England, 3 of which are fatal, making 30 cases with 9 deaths, or 33.3 per cent. Amputations at the forearm yield only 12.25 per cent. of deaths.

If a patient absolutely refuse to suffer amputation, and removal of the disease be necessary, the surgeon may, having placed the dangers before the patient, consent to practise resection at this joint; but the high ratio of mortality, and the crippled condition of the part saved, should forbid his proposing such a procedure as a reliable means of treatment.

Concerning *removal of the head of the femur*, much attention has been of late years excited in England by the well-known paper read by Mr. Fergusson before the Medico-Chirurgical Society,[2] and by the considerable success attending some operations performed by that surgeon at King's College Hospital, followed by certain papers in the *Lancet*, 1848, by Mr. H. Smith, praising very highly the procedure. But we are bound to confess, although the first-recorded cases of excision[3] are English, that we lagged behind the German surgeons in continuing this operation. White operated in 1822; Hewson, of Dublin, in 1828. From this time to Fergusson's first operation, no other case occurred in this country; but during that period Textor the elder resected the head of the thigh-bone four times, and two other surgeons had operated twice, but of these six cases only one recovered. Since 1848 the operation has been increasing in credit, both in England and in Germany, and we are now able to give a succinct account of its effects.[4] I can thus gather altogether 104 cases. Twelve times the operation was performed for injury (eleven times gunshot injury, once for fracture of the neck of the thigh and descending ramus pubis). Of these 12 cases but 1 recovered. Of the 92 cases in which joint-disease was the cause of operation, we find that 56 recovered, 32 are dead, 4 remain uncertain. Therefore, in 88 cases, 56 recover. Thus, the recoveries stand at the high ratio of 63.63 per cent. It must be, nevertheless, acknowledged, that several of the patients, after having lived and even walked about for some months, or even more, ultimately succumbed to internal disease, generally to tuberculosis.

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[1] "Medical Times," vol. i. 1860, p. 366.

[2] "Med.-Chir. Trans.," 1845.

[3] That of Schlichtling, and, many years afterwards, A. White Sayre, in his paper on this subject, New York Journal, Jan. 1855, gives a list of cases, at the head of which stands the name of Schmalz (1816), taken, it is to be presumed, from Jäger's table (Operatio Resectionis Conspectu Chronologico adumbrata), and which Fock leaves out.

[4] I am greatly assisted in the following statistic numbers, particularly for foreign cases, by a Table which is contained in a valuable paper by Dr. C. Fock, of Magde-

Concerning the power or use of the limb afterwards, it is necessary to speak with the greatest caution. Very many of the cases, after having been reported as cured with perfect use of the limb, have been lost sight of just when the critical time for testing the use of the member has arrived. Many of these are, I believe, dead; others have not so much use in the limb as the first result of the operation might lead us to expect. We may tabulate the only attainable numbers thus; but the quantity of "useful limbs" is very much too high. Of the 56 recoveries I get no reliable information in 14—in 6 the limb is useless, in 36 the limb is reported as useful.[1]

Our views concerning the indication or contra-indication of any operation on the hip have been so much modified by Mr. Hancock's celebrated paper "On Excision of the Head of the Femur and Floor of the Acetabulum,"[2] that that surgeon may be consi-

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burg, in the "Archiv der Chirurgie," No. I. The cases which he has gathered altogether are 90: 46 English, 7 American, 34 German, 2 French, 1 Belgian. The earlier of the English and American are taken from Dr. Sayre's and Heyfelder's table. I have been able to add the results of 10 out of the 14 cases which Dr. Fock was obliged to leave uncertain, and to add 14 more; for information concerning 3 of these latter I am indebted to the kind assistance of Mr. Price.

[1] These numbers are thus got together: Dr. Fock gives of all his 90 cases 78 as being performed for joint-disease; of these 38 recovered, 26 died, 14 are doubtful. He obtains authentication of a useful limb in 22 cases only. I obtained, through the kind replies of the profession to my inquiries, authentication of a useful limb in 6 out of the 14 cases he was obliged to leave uncertain, and of 8 out of the 14 which I have added to his Table. It may be permitted me to add that in the case of Mr. A. White, of the Westminster Hospital, it is especially noted (Pathological Catalogue, College of Surgeons' Museum) that the limb did not grow after the operation.

[2] Lancet, April 18, 1857.

dered the originator of real excision of the hip-joint. Previous to 1857, the presence of much acetabular disease was considered by the whole profession to forbid any operation. Only one part of the joint, viz., the head of the thigh-bone, was removed. The operation was not excision of the hip-joint, but decapitation of the femur. Thus, before Mr. Hancock's views were promulgated, there was always a certain fear in each case that the cavity might be greatly diseased. Many surgeons held that the head of the thigh-bone should only be removed when it is dislocated, and some asserted the proceeding to be altogether unjustifiable. But we are now in a position to affix far more reliable and scientific guides for the operation. In the first place, it must be remembered that, unlike other excisions of joints, this procedure may be adopted for the mere purpose of saving or of prolonging life. That it does so in very many cases, is evident from the numbers already given, and particularly when it is considered that a great proportion were certainly subjected to the operation when already they were almost *in articulo mortis.* But the 56 who recovered the operation were not all able to make use of the limb. Some died soon after of internal disease, and some still living can walk very considerable distances without difficulty. The questions to be considered are, what circumstances warrant operative procedure for any purpose beyond the mere preservation of life—that is to say, what condition is sufficiently mild to justify an expectation that operation will restore a useful limb, and yet sufficiently severe to cause us to despair of restoration without operative interference?

For some of the first part of this query, answer must be sought in those circumstances which were treated in section C of this chapter; but it must be remembered that at this joint we have two states to deal with, viz., the dislocated and the not-dislocated. Till quite of late years, it has been held only justifiable to decapitate the femur when that bone is displaced and lies upon the dorsum ilii; but subsequent experience has shown that this circumstance affects the case only inasmuch as it renders the operation a little, but very little, more easy. I do not feel sufficient confidence in the details of tabulated cases such as have been published, nor of very many such instances as I have been able to gather, to warrant my giving numbers and proportions; but it may be said that the evidence of my list, as far as it goes, is, that the operation in cases of luxation is rather more fatal than when the bone is not dislocated. If this conclusion be correct, the circumstance is to be attributed to the greater state of exhaustion probably present in the former class of cases.

Of abscesses, and their influence upon the decision, it need only be said, that as long as a great quantity of bone be not diseased, there is scarcely any extent of abscess on the surrounding parts that should prevent our operating. Even abscess in the pelvis is no bar to such procedure; but it must be clearly made out that the pus-collection is not connected with spinal disease. It does not suffice merely to ascertain its communication with the hip, but absence of all relationship between it and the spine must be proved. At p. 316 is a quotation from Mr. Hancock's paper, showing the mode of diagnosis between the one state and the other. The same authority may be judiciously quoted concerning the significance, the treatment, and the prognosis of pelvic abscess, and at the same time also of acetabular disease.

> "It is only in a few rare instances that the surgeon can tell beforehand what is the condition of the cotyloid cavity; but supposing he can do so, that a patient presents, whose condition imperatively calls for operation in all respects, but that the acetabulum is extensively diseased, are we to abandon this patient to his fate, and suffer him to die in agony? Is it not rather an additional reason for performing the operation? since the greater the amount of disease the smaller the chance of recovery; whilst the value of an operation does not consist in the facility of its performance, but in the urgency of the symptoms, and the extent of disease and suffering it is capable of removing. It is very true that, in the majority of instances, the bones of the pelvis appear to possess a wonderful power of reparation. The cases operated show this." . . . "It would seem, therefore, much the safer to remove the doubtful portion of the acetabulum than to leave it behind, or merely scrape it with a gouge."
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> "Mr. Coulson and Mr. Henry Smith lay considerable stress upon perforation of the acetabulum as an insuperable barrier to the operation: but if I am able to prove that instead of being so, the operation may be performed under these apparently unpromising circumstances, it will, I am sure, be agreed that its application to such cases eminently enhances its value, since it affords a prospect of cure to an amount of disease hitherto considered irremediable. Presuming always, that the disease is confined to these limits, that the viscera and spine are healthy, and the lungs free from tubercles, I do not understand why a pelvic abscess, depending upon hip-disease, or caries of the pelvis, should not be cured as well as any other abscess connected with caries elsewhere, provided it can be reduced to the same condition. The amount of caries is often comparatively small, and though capable of causing excessive discharge is confined to the limits of the acetabulum and the part perforated. In pelvic abscess, depending on hip-disease, the head of the bone is often retained in the acetabulum after perforation of the latter has obtained; the matter thus escaping from the

joint, the same lull in the constitutional symptoms takes place, as is so often observed after spontaneous dislocation.[1] Such abscesses are not cured, because the matter, if left to itself, cannot find a depending exit. I cannot understand how so celebrated an anatomist as Dr. Knox could have asserted that the pelvic portion of the hip-joint is beyond the reach of excision. In cases requiring it, the pelvis may be reached at almost any point. Mr. Syme has recently removed necrosed bone from the tuber ischii; and in another case, from the ascending ramus of the ischium and inner margin of the pubic arch.[2] The ilium is separated from the peritoneum and fascia by the iliacus internus; the ilium, ischium, and pubis, opposite the joint and beyond, are separated from the abdominal and pelvic cavities and viscera by pelvic and obturator fascia, the obturator and levator ani muscles. The matter in pelvic abscess from hip-disease is outside the obturator fascia, between it and the bone separating the former from the latter, and causing a considerable interval between the two, so that the whole of the cotyloid portion of the pelvis, and for some distance beyond, may be removed without any risk of injury to the pelvic contents. But it may be asked why the spontaneous opening of a pelvic abscess may not effect a cure equally with one made through the acetabulum? We find answer in the shape of the pelvis, for when the patient lies on this side the cotyloid portion is depending, so that when a free opening is made in that situation, and the patient is turned over on that side, not only does the matter find a free and depending exit, but the contents of the pelvis gravitating upon the abscess tend to consolidate the parts, obliterate the cavity, and effect the cure. I need scarcely observe, that before undertaking these operations, we should make a very careful examination of the patient, and as far as possible convince ourselves of the absence of disease elsewhere."

Here follow the precise and distinct rules for such diagnosis, already quoted, p. 316. Mr. Hancock goes on to say:—

"In some cases of hip-disease an abscess forms in the pelvis before actual perforation of the acetabulum occurs, though, in all probability, depending on the disease going on in that cavity.[3] In such cases, should the connection be clearly made out, and circumstances warrant operative interference, the floor of the acetabulum may be readily perforated by a trephine, and any amount removed by a metacarpal saw. So, likewise, in those cases in which there is neither pelvic abscess nor perforation, but extensive disease of the acetabulum, I cannot see the objection to the operation. Here we have a patient actually dying; we know that an operation holds out the only chance. The whole of the acetabulum, even in a healthy condition, may be removed without penetrating the cavity of the pelvis, or injury to the parts contained; the whole of the operation is external to the obturator muscle, consequently to the levator ani, and so far extra-pelvic. And if it can be done thus easily when the parts are healthy, it can be done with still greater facility when the acetabulum is much diseased, and when, in all probability, the internal periosteum and obturator fascia will be detached from the bone."

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[1] In my opinion this lull is better to be compared with that which occurs between the second and third stage of hip-disease. See p. 310.—R. B.

[2] Lancet, January 6, 1856.

[3] From some instances that have come under my notice, I believe that in such event the bone is carious on the inner side, and may be felt with a probe bare and rough.—R. B.

These considerations may suffice to answer the question as to the gravity of disease which should forbid operation.[1] The query concerning the amount of malady which should cause us to despair of curing our patient by other means, and therefore to resort to excision, is even more difficult of response. I have already given an opinion that the operation should not be so much regarded as an ultimate resource to be employed only because amputation is worse than useless; it should rather be viewed as a means whereby we may yet procure to our patient a valuable limb (p. 333); but I cannot go the length of Dr. Fock, when he observes that "the proper moment for the operation has, according to our view, arrived as soon as caries of the joint has been diagnosed with certainty."[2] Complete rest alone has, in several instances in which caries was clearly present, permitted the disease to get well; but the application of an extending force, by preventing pressure of the joint surfaces, has a greater effect. Moreover, it must be considered that the part left behind is not so likely to be useful as a limb recovered from disease at the hip-joint.

In the present high, perhaps somewhat too high value which is accorded to the operation of excision, it is to be feared that patients may be unnecessarily subjected to that treatment rather than that the operation will be too much dreaded. We should recommend that when a case even if external abscess be already formed, the efficacy of extension be fully tried: if in a night or two the starting pains greatly diminish, and subsequently cease, the proposal of excision should be postponed until general symptoms, the formation or increase of pelvic abscess, &c., warrant return to such consideration.

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[1] Concerning the amount of exhaustion and hectic, see p. 415. It must, however, be observed that as amputation at the hip is inadmissible for joint-disease, and as that malady reacts with greater violence upon the system, excision may be performed upon a patient in a farther advanced state of hectic than might be judicious for other joints; absence of visceral disease being always postulated. Indeed Dr. Fock very rightly observes that "the operation has afforded the most brilliant results in these apparently hopeless cases."

[2] "Bemerkungen und Erfahrungen über die Resection im Hüftgelenk,"—Archiv der Klinischen Chirurgie, 1ster Band, 1stes Heft, p. 197.

The operation itself is not difficult; less so on the living subject, when the parts are diseased, than on the dead body with the joint perfect. The patient lies on the sound side, and if the head of the bone be dislocated, a crucial or T-shaped incision exposes the part sufficiently. It should be cleared of soft parts, and a broad-grooved and curved director, or, what perfectly answers the purpose, a large lithotomy-staff, is passed under the bone at the place where disease ceases; it may then be turned half-round, so as to present its grooved side uppermost; over this the surgeon applies an amputating saw, and may fearlessly cut through the bone, as the staff protects the soft parts beneath. If there be no dislocation, the surgeon commences his incision about two inches above,[1] and a little in front of the great trochanter, and carrying it in a semilunar shape, allows it to terminate behind that portion of bone; another incision runs from the middle of this, forwards, a little beyond, the anterior edge of the trochanter. The flaps, including the whole, or nearly the whole thickness of the soft parts, being dissected up, the back and top of the articulation will lie bare. If the cervix femoris be diseased, or if there be any anchylosis, it is better to saw off the bone previous to dislocating it; indeed, it is best, probably, to follow that plan in nearly all instances, as Stromeyer observes.[2] The head of the bone can then easily be dissected out, or, if partially anchylosed, gouged out of the cavity. If the acetabulum be only diseased in spots, free use of the gouge suffices to remove the carious portion; but if it have suffered extensively, and certainly if its floor be carious, the trephine, the metacarpal, Hey's saw, or all three may be used, according to the convenience of the operator. The disease being quite removed, the wound is to be closed by sutures, except at the lower part, which is left open to afford a drain for pus. A splint is to be applied before the patient leaves the table.

As during the next few weeks the patient must lie on the back, proper means must be adopted for cleanliness and ease, so that he may not get bed-sores nor be unnecessarily moved and shifted. Mr. Christopher Heath has invented a very clever arrangement like a hammock slung in a large four-legged stand: this supports the back and thighs; the head and legs projecting beyond are lodged upon cushions. A hole about the region of the buttocks presents arrangements for cleanliness and for dressing the wound. This method has found considerable favor in Germany, being highly praised in the *Journal für Kinderkrankheiten*,[1] where a very droll figure is given, and Dr. Fock mentions it as capable of affording ease and advantages in certain cases wherein every other method has been unavailing.

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[1] These dimensions suppose that the patient be full grown.

[2] "Maximen der Kriegheilkunst," p. 505, 2te Auflage.

A long Desault splint, reaching from the axilla to the foot, is the best way of keeping the limb motionless. By removing from such a splint the part that would cover the hip, and then bracketing the lower and the upper portions together by loops of steel, the wound can always be easily got at. Mr. Price has made an arrangement by means of which the lower part of the splint can be depressed, adducted or abducted by means of screws at the steel bracket. Also he uses a pelvic band like that already described (p. 321) for a splint in hip-disease, and I believe adapted from my principle.

Generally, after excision of this joint, the soft parts swell very considerably, become, indeed, sometimes white and rather tense, and do not begin to decline until suppuration comes on. During this time, cold water is the best application, and even afterwards, unless any circumstances call for some local stimulant; but it is not wise to endeavor to repress the surface granulations, which are always florid and large when the case is doing well. Neither during the first weeks after the operation is it judicious to use extension, nor other movement;[2] but when the parts begin to consolidate, the limb may be drawn a little downwards, either by the screw or by the India-rubber extension apparatus.

CASE OF EXCISION OF THE HIP-JOINT.[3]

CASE LXIII.—Timothy Dacey, aged 14, admitted under my (Mr. Hancock's) care into Charing-Cross Hospital, July, 1856, with disease of the hip-joint. Five years before, observing a swelling in the groin, he attended at the Middlesex Hospital, but got worse and was made an in-patient. He remained there five months. Two years afterwards abscesses formed round the joint, and eighteen months ago he first came under my care at the Charing-Cross Hospital, where he remained three months, when he left apparently cured. He continued able to walk for ten months, when he was attacked with severe pain in the knee, which increased so much, that, upon his application, I again admitted him into the hospital. Shortly afterwards, abscesses formed around the hip-joint, opening behind the trochanter, and also low down on the back of the thigh, and subsequently an abscess burst in the groin; and a probe introduced into this opening passed readily into the pelvis. He, in the course of time, became so emaciated and worn out with the profuse discharge, night-sweats, loss of appetite, &c., that it was evident he could not long survive if something were not done for him. Great prostration and cough supervened, and his sputa became streaked with blood; I therefore requested Dr. Willshire to examine the lungs. He did so, and pronounced them free from any cause contraindicating an operation. Having as far as possible ascertained that the disease was confined to the hip-joint and pelvis, I examined the inside of the latter with a probe through the opening in the groin, and then discovered perforation of the acetabulum. Under these circumstances I concluded that the pelvic abscess, and the boy's condition generally, were due to hip-disease, and that by removing the head of the femur and the floor of the acetabulum, I might not only get rid of the diseased bone, but by affording a free and depending opening for the discharge of the matter, the pelvic abscess might be approximated to the condition of an ordinary abscess, and thus the patient be saved; and I therefore proposed to my colleagues to remove the head of the femur and the floor of the acetabulum, and so much around it as the extent of the disease required, the patient having agreed to undergo whatever I might advise.

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[1] Band xxx., S. 412.

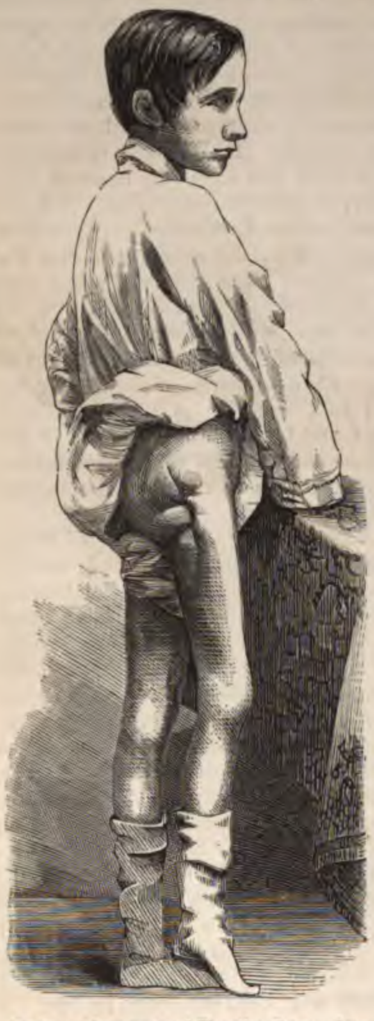
[2] Fock says that the only two exceptions to this rule are: 1st, when the thigh, during the operation, could not be quite straightened; 2dly, when the bone, being dislocated, lies so high on the ilium, that union in this place would cause too much shortening.

[3] From the paper by Mr. Hancock, Lancet, April 25th, 1858.

On the 6th of December, 1856, the patient having been submitted to the influence of chloroform, and placed on his sound side on the table, I, assisted by my colleagues, commenced the operation by making a crucial incision over the great trochanter, extending about three inches beyond in all directions. The flaps having been reflected, a circular incision was carried round the head of the bone, which remained in its cavity, cutting through the glutæi, the muscles inserted into the digital fossa, the pectineus, &c., and opening the capsular ligament. Upon examination with the finger, the neck of the femur was discovered to be so much involved that I decided upon cutting through the bone immediately below the great trochanter, after which its head was removed without difficulty. When this was done, the acetabulum was found to communicate, by two openings at its deepest part, with the pelvic abscess. I endeavored to excise the floor of the acetabulum with the bone-nippers, but could not; and, therefore, with the metacarpal saw I cut round the acetabulum, removing the whole of the diseased bone, exposing the thickened pelvic fascia, and leaving a large opening for the escape of matter from the pelvic abscess. The flaps were then brought together and united by sutures, except opposite and below the opening in the acetabulum, where they were kept separated by lint. A splint, extending from the armpit to the foot, was next applied, as the leg could not be straightened without difficulty, and the patient returned to his bed. Very little blood was lost during the operation, and no vessels required tying.

The operation was followed by almost instant relief of his constitutional symptoms. He was a little sick for the first forty-eight hours from the chloroform, but otherwise his course has been one of uninterrupted improvement. His countenance soon became cheerful and free from anxiety; his night-sweats ceased in two days from the operation. On the third day the wound in the groin was entirely healed. The discharge from the wound made at the operation, which, for the first few days, was very abundant, gradually became thicker, and diminished in quantity, until it did not amount to a teaspoonful in the twenty-four hours. He was able to sit up in bed, for the first time for nearly a year, with the knee straight, in fourteen days after the operation. In three weeks he dressed himself and sat in a chair by the fire. In five weeks he was able to walk with a crutch and a stick; at the end of eight weeks, however, he imprudently dispensed with both crutch and stick: inflammation ensued, followed by abscess external to the pelvis. This, however, soon subsided, and he then progressed steadily, gaining flesh and strength. At the beginning of April, 1857, he was able to enjoy daily a walk in the Park. At this time a photogram was taken, from which the woodcut, Fig. 27, is copied. On May 15th, 1857, the boy went down to Ramsgate, where he imprudently employed himself in taking much walking exercise. On the 6th of July, 1857, he returned to the hospital with phthisis, and died on the 13th of July, 1858.

Fig. 27.



From a photogram of Timothy Dacey, four months after excision of the right hip.

It is interesting to observe the mode in which the truncated end of the femur and the pelvis act, so as to acquire a new point for the support of the body. On examination of this patient, it was found that the end of the femur abutted against the sawn surface of bone which represented the upper margin of the acetabulum. It was inclosed and shut into the cavity by a tough, fibrous capsule, which was deficient at the posterior part, whence pus escaped (a portion of this capsule is represented hanging down as a triangular fold). On turning out the end of the femur, it was found rounded off; the extremity of the medullary tube was partially closed in by a thin plate of bone. The opening still remaining had jagged, uneven edges, and it seemed as though the osseous covering had at some former period been complete, and had subsequently yielded to the absorption produced by pressure at that part. The cavity which took the place of the acetabulum was roomy, and had a large perforation still patent. The upper part, against which the end of the bone had pressed, was covered by a thin but dense fibrous structure; at its back was a carious spot, about the size of a sixpence, the diseased action being quite superficial. A singular adaptation of parts, in order to compensate for the absence of the cervix femoris, was found, namely, a bending inwards of the descending ramus of the pubis and of the ascending branch of the ischium. The pelvic abscess was consolidated, and the iliac fascia was tightly stretched over the opening in the acetabular(?) cavity.

Fig. 28.

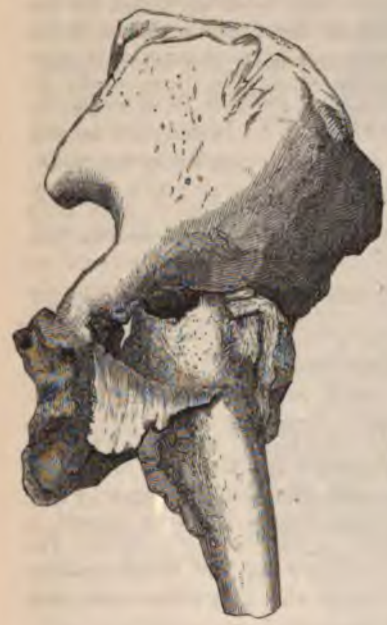


Fig. 29.

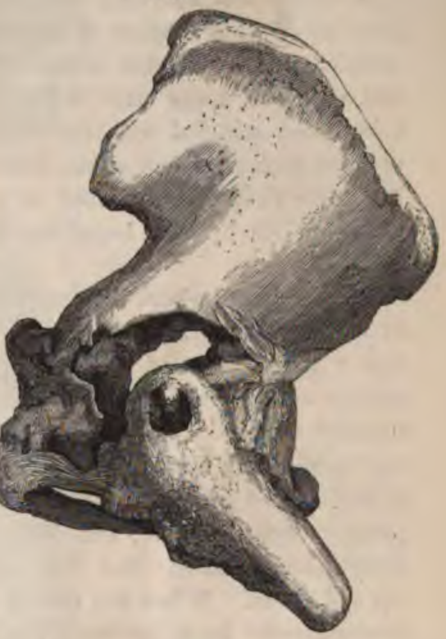


FIG. 28.—Condition found nineteen months after excision of the hip—parts in situ.

FIG. 29.—Condition of parts nineteen months after excision of the hip-joint. The femur turned out of the cavity.

The boy who was operated on by White died some five years afterwards, and the parts are preserved in the Museum of the College of Surgeons. "Both the os innominatum and the remains of the femur are slender, small, and light. The upper part of the shaft of the femur is placed opposite the posterior part of the acetabulum, to which, as well as to the adjacent part of the ilium, it is firmly but movably attached by dense ligamentous tissue, portions of which appear to be formed of the capsule of the joint doubled in between the bones. Connected with the same tissue, and with the upper part of the shaft, is a portion of muscle, inclosed and mingled with the cellular tissue."[1] It may be added that the truncated end of the femur appears to rest upon no bone, but to be simply invaginated in a fibrous socket, which is bound to the pelvis by firm, broad bands, clasping the pubis, ilium, and ischium.

The girl from whom the annexed figure is taken was operated on in 1848 by Mr. French, of Marlborough Street.[2] The head of the femur was dislocated upon the dorsum ilii. The acetabulum almost obliterated. The bone was sawn off just below the trochanter minor. The girl was ten years old when the operation was performed, therefore is now twenty-two; is five feet four and a half inches high. The truncated end of the femur lies in the greatly depressed scar, and is evidently bound to the pelvis by dense fibrous tissue. She has power of flexing the thigh a little up and down. When she stands upright, the foot does not come to the ground by 4½ inches. The measurements on the sound side are, thigh 13¾, leg to sole 16 inches; operated side, thigh, 11½, leg to sole 15 inches. Thus the actual loss of length is but 3¼ inches. We cannot then conclude that the femur has ceased to grow; it is even now only 2¼ inches less than that of the sound side, and there could not have been much less than this removed during the operation. Of the other 2¼ inches lost, one is absent from the lower leg, the other is accounted for by the position of the thigh, which is adducted very much inwards, so that the knee tends to cross the other. This is compensated for by abduction of the leg at the knee, the position being that of genu valgum. Whenever she bears slight weight on the limb this malposture increases, and she cannot support more than a few pounds pressure. The limb is altogether very deficiently nourished, the knee is $\frac{7}{8}$ inch less in circumference, the foot $1\frac{1}{8}$ inch less in length than on the sound side.

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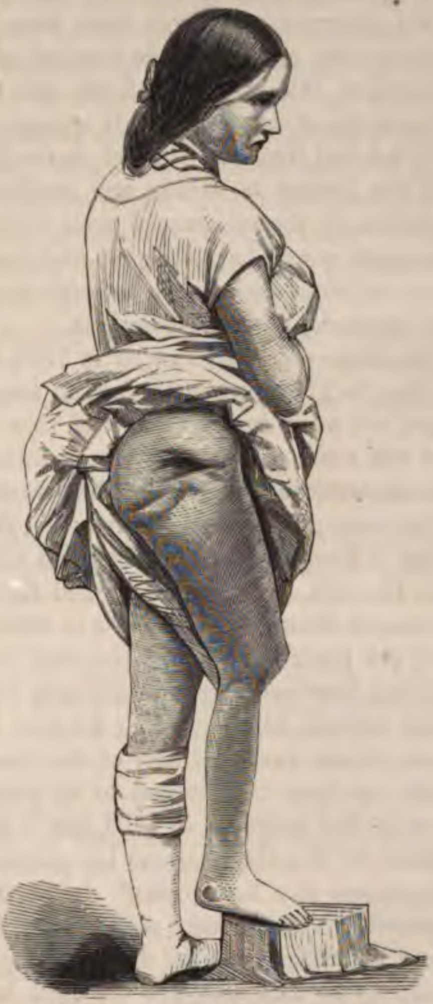
[1] Catalogue of the Museum of the College of Surgeons, Pathological Series, vol. iv.

[2] A portion of this case is reported in the Lancet, 1848. I am indebted to Mr. French for kindly giving me further details, and for allowing me to have the photograph taken, from which the woodcut is copied.

Fig. 30.



M. E., twelve years after excision of the hip.

The operated thigh is round and full, but soft and flabby; the leg very small. In consequence of the ill-nutrition the foot is ulcerated.

Dr. Rhea Barton, of Philadelphia, excised from the neck of a femur, anchylosed at the hip, a wedge-shaped piece of bone, and treated the case like an ordinary decapitatio femoris, instituting, after the lapse of six weeks, passive motion. The man, a sailor, did very well, and regained use of the limb, which previously had been bent up on the abdomen. Such operation may be justifiable if the anchylosis be diagnosed as true, and the deformity such as entirely to forbid progression. There have been but few, if any, imitators of this practice, and I am able to speak of it only according to the light which this one case affords and to the theoretic principles of operations of expediency. It appears that the danger of such procedure is not likely to be great, as no important part is implicated. If the patient be strong and healthy, whose life is rendered burdensome by the existence of great deformity, it appears that such a procedure would be justifiable, and likely to benefit in most cases, since excisions undertaken for true anchylosis are the most uniformly successful of such operations.

Excision of the Knee.—Mr. Filkin, who in 1762 first performed, and Mr. Park, who in 1782 first published an account of excision of the knee-joint, had more imitators abroad than in England till within the last ten years, and now their conditions are exactly reversed. Park operated again in 1783, but unsuccessfully. No one followed his example in this country till 1823, when Sir P. Crampton excised a knee, cured his patient, and a second time was less successful. In 1830, Mr. Syme performed the sixth operation that had been done in Britain. From 1830 to 1850, when Mr. Fergusson revived the procedure in this country, it was not once attempted. Its fate, however, had been different abroad. Moreau père took up the method, and imparting his zeal to his son, they performed among others two excisions of the knee.[1] In France, however, a check was here experienced to its progress. In Germany, Mülder, who had operated in 1809, found no successor till 1821, when Textor, of Wurzburg, began his career, and in twenty-one years had excised five knee-joints.[2] In 1850 Mr. Fergusson revived this operation. The patient died on the ninth day, apparently of purulent infection. But the discouragement which might have been produced by this case was obviated by Mr. Jones, of Jersey, who was sufficiently bold to try the procedure six months afterwards, with perfect success; and again four months later, his third patient (September 4, 1851) died of diarrhœa, followed by dysentery. Since that time, the operation has been performed frequently, both in London and in the provinces. Its results as to mortality may be stated with tolerable accuracy, but the ultimate benefit to the patient cannot be so perfectly ascertained.

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[1] The father two, 1792. The son one in 1811.

[2] "Die Wiedererzeugung der Knochen nach Resectionen."

Mr. Butcher's first and second Memoirs "On Excision of the Knee-Joint,"[1] give full information on the records up to the year 1856. A table in the first Memoir gives all the cases up to 1854 inclusive; one in the second, up to 1856, also inclusive. The two together enumerate 82 cases. Mr. Price, whose zealous advocacy of this operation is well known, has collected 78 additional cases, making up the number to 160.[2] To this I can add 6 more English cases, and will also include the 15 cases lately published, as occurring in the practice of Dr. Heusser, of Hombrechtikon, canton Zurich,[3] thus making 181 cases. Of these, we find that 39 died (two after amputation); 20 got well, after amputation; 122 recovered: *i. e.*, 21.54 per cent. die, 11.05 per cent. require amputation (whereof 9.5 per cent. die), 67.4 recover with more or less useful limbs.[4]

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[1] Dublin Quarterly Review, 1855 and 1857 respectively; and since published in a separate form.

Butcher's table, which refers to cases before 1850 (First Memoir "On Excision of the Knee-Joint"), gives incorrect numbers for one or two of the German surgeons; thus Textor had 5 cases, not 2: three of them proved fatal. Ried, whose name is not mentioned by Butcher, had 4, with 2 deaths, before the year '47. Fricke had only 2, not 4; and they both recovered. I can find mention of only one such operation by Jäger, in his article on Decapitatio Ossium in Rust's Handbuch, and the case recovered. Three of Dr. Heusser's cases, all successful, occurred before 1850. Thus I make of the German surgeons' cases, before 1850, 15 with 5 deaths; if we add these to all the English and French cases prior to that date, we have 26 cases, with 16 recoveries and 10 deaths. 1 death is from tetanus after delivery; 1 from dysentery;—1 of the recoveries had not a useful limb.

[2] Contributions to the "Surgery of Diseased Joints, with especial reference to the Operation of Excision," No. I.—The Knee.

[3] "Deutsche Klinik," 1860, No 42.

[4] A habit, in gathering statistic numbers, of affirming that certain of the deaths are "not due to the operation," may, and I believe does, lead to a great deal of unintentional falsity; with the best possible will to promote truth, the writer is easily led away by bias for or against a particular fact. Whenever a person not yet recovered from an operation succumbs to some endemic or epidemic disease, the operation acts as at least a predisposing if not an immediate cause of death; and who shall say that the patient would not have escaped the fatal disease, or recovered from it, had he not been confined to a particular locality, or debilitated by an operation? In the numbers given in the text for all cases I place on the list of mortality from operation, all deaths occurring before the patient is up and about.

The mortality from amputations at the thigh has been variously estimated, as we have already seen: at the Hôtel-Dieu, about 60 per cent. die; in the London Hospitals, about 44; in the Edinburgh Hospitals, 49 per cent. die. The result of Paul's large statistic gathering is, that of 1,003 cases, 454 die, or 45.27 per cent. These numbers include accidents, gunshot injuries, &c., and would show greater mortality than if they referred to chronic disease.

In an excellent paper by Mr. Bryant, on the "Causes of Death after Amputation,"[1] the mortality for all amputations at the thigh is given as being only 27.27 per cent. At Guy's Hospital, amputations for chronic knee-joint disease bear a mortality of only 14.5. Mr. Bryant takes occasion to observe that "the fatality of excision of the knee-joint is, according to Butcher at least, 1 in 5," which is about the proportion we find for a larger number. But we must confess surprise at the very low rate of mortality for thigh amputations at Guy's Hospital, and suppose that the 146 cases were collected during some fortuitously favorable epoch.

In what proportion of cases, which are returned as with perfect use of the limb after excision of the knee-joint, a valuable member is retained it is impossible to say; but that we must not suppose all such limbs to remain useful, I know from having seen two or three men in different institutions, who, as they walked about, and at last out of the hospital, extremely well, justified the report of "perfectly sound limb;" yet who, at various periods, have returned under care with some defect. The union perhaps yields, and the limb, bending outwards more and more, becomes less and less available. Or the man will have gone away with a sinus open; it is justly said that such sinuses often do remain open for months, and then heal; but sometimes they do not heal, and then a year or so afterwards dead bone will be found, which may require removal.

Another point, affecting, of course, only young persons, is the subsequent failure of growth in the limb. This subject, although it certainly comes into consideration in reference to all joints, has been deferred to the present time because the knee is peculiarly situated in this respect. Mr. Syme was the first who observed that, after excision of the knee-joint, the growth of the two limbs did not remain equal. Speaking of his operation in 1830, he says:

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[1] "Medico-Chirurgical Transactions," vol. xlii. p. 75.

"The growth of the two limbs was not equal, and that the one which had been the subject of operation wanted several inches of reaching the ground when the patient stood erect."[1] Mr. Butcher, however, in his first and second Memoirs, repudiates the notion that growth could be checked by excision of the knee, saying, especially in the second, that such was not borne out by fact. Mr. Humphry had, in 1857,[2] already pointed out that care should be taken not to remove the whole epiphysal end, since he judged, from his great knowledge of osseous growth and development, that if such precaution were attended to the limb would not cease to grow. Still this consideration, like Mr. Syme's case, excited little attention, as they appeared to be overruled by superior facts quoted by Mr. Butcher, until Mr. Pemberton, of Birmingham, again called the attention of the profession to this subject, in a most admirable series of papers.[3] Mr. Pemberton gives the result of excision of the knee from a boy, aged twelve. The operation was performed in 1853. "The amount of bone removed measured rather more than 3½ inches. About two and a half belonged to the femur, about one inch to the tibia." In October, 1859, the lad being then eighteen years old, the limb is found nine inches shorter than the other. Dr. Keith, whose case is one of those to which Mr. Butcher had referred as disproving loss of growth, was then written to. He had operated on a boy, aged nine, in 1853. In the beginning of November, 1860, Mr. Pemberton receives a note from Dr. Keith, containing the following measurements:—

"He is now a stout, healthy boy, in his fifteenth year, his left, or sound, lower limb being long and well-developed. His right limb is really plump to look at, but seems a mere appendage to the body, when compared with the other limb; the right limb being now seven inches shorter than the left limb, from the anterior superior spinous process of the ilium to the heel.

"At the thick of the thigh, the left measures 17 inches round; the right 16. Left 12½ inches; right, 12. Around the calf of the leg, 11½ inches; right, 10½.

"In length, the left limb is 17 inches from the anterior superior spinous process of the ilium to the centre of the patella, and 17 inches from the same spot to the sole of the foot—in whole, 34 inches; while the right was only 12½ to 14½; total, 27 inches."

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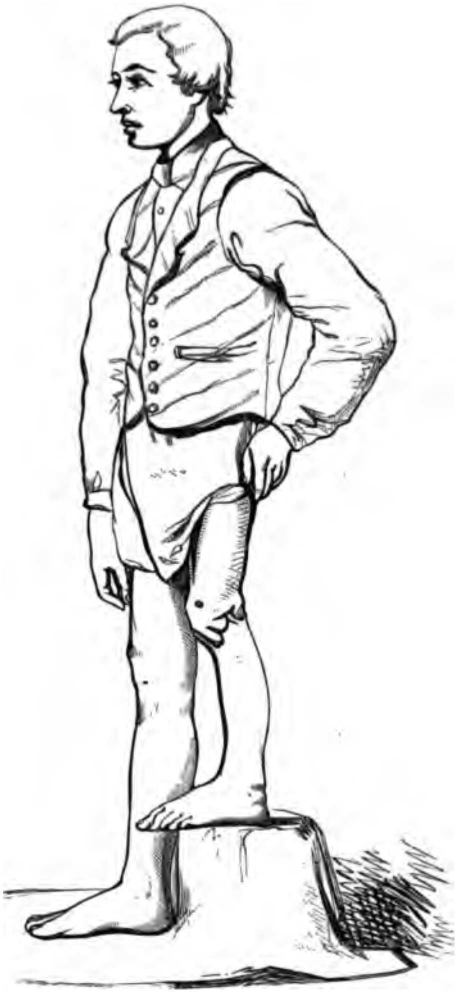
[1] "Pathology and Principles of Surgery," p. 225.

[2] "Medico-Chirurgical Transactions."

[3] "British Medical Journal," Nov. 26th, 1859.

Fig. 31.



Shortening after excision of the knee. (From Mr. Pemberton's paper.)

In December of 1859 I wrote to the *British and Foreign Medical Journal* a letter, pointing out the reasons of this peculiar tendency to loss of growth, observable especially in the femur:—

"In the case which Mr. Pemberton quotes as the first in which he had excised the knee-joint, an unusual quantity was removed from both bones.

There is no doubt that the epiphyses were taken away. I have had no opportunity of examining the case itself; but Mr. Pemberton gives a woodcut, which we must presume to be accurate. On comparing carefully the length of the two thighs, and of the two lower legs, I find that the difference between the two former is, as nearly as possible, double the difference between the two latter. It is to be observed that both femur and tibia have an epiphysis at either end: those of the latter bone are horizontal and parallel; the growth in length of that bone takes place at both ends; hence, when its upper epiphysis is excised, it has still one end from which it may grow. But the upper epiphysis of the femur is very oblique, almost perpendicular, and growth from that end only takes place by the little that may be added to the length of the neck, and even that little in an oblique direction. Growth in length of the bone is, therefore, effected almost entirely from the lower epiphysis, and this is doubtless the reason why that epiphysis should remain longer ununited than any other in the body. When, then, this part is excised, growth in length of the femur must be very small. Hence, in Mr. Pemberton's case, the femur has lost double as much of its length as the tibia: if my measurement from the woodcut be correct, the femur will have lost six inches, the tibia three.

"These observations are greatly confirmed by the letter of Dr. Keith. In the case there mentioned equal portions were removed from the femur and tibia; in little more than three years afterwards the measurements are these: Healthy femur and tibia, each, 17 inches; operated femur and tibia, 12½ and 14½ inches respectively. One loses 4½, the other 2½ inches, which follows sufficiently closely, within one-sixth of an inch, the law of double loss of growth from the femur."

Shortly after publication of the above letter, I received from Mr. Pemberton a courteous note, informing me that my surmises as to the length of the limb were correct. Thus, it is evidently of extreme importance to preserve the epiphysal junction in all patients below eighteen years of age. The operator must, however, be aware that the anterior part of the joint is by far the highest point of the epiphysis, and if he saw off the bone in a line with the upper termination of the cartilage in this aspect, he will have removed the whole, and more than the whole epiphysis. The entire articular cartilage is, as we have seen (p. 21), formed from the epiphysal cartilage, of which, previous to ossification, it was a part; but the portion on which the patella rests lies much higher than any other, so that, on making an antero-posterior section of a thigh-bone in a longitudinal direction, this portion will be found running up far above the general level of the epiphysal junction.[1] The surgeon must look at the side of the joint to find where the epiphysal junction takes place. It is just below the attachment of the internal lateral ligament, on one side; below the origin of the popliteus on the other.

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[1] In animals whose patella enjoys great mobility, the hare, rabbit, rat, and other leaping creatures, this pointed projection upwards of the anterior part of the epiphysis is often double, in the hare and rabbit more than three times the length of the rest of the structure.

Suppose that some bone, sparing the epiphysal junction, have been cut off, but the part remaining, and the cartilaginous junction, appear still diseased to a certain depth which might be removed, but with the certainty of procuring a shortened limb, is it better to proceed with the excision, or to amputate? Dr. Keith's patient expressly says he would rather have his shortened leg than a wooden one, and it appears that we must regard the limb as an operation stump, longer and more convenient, probably, than we could procure by amputation.

It will be seen that all the cases put down by Mr. Butcher, with perfect truth at the time, as recovering with complete use of the limb, did not continue in so favorable a state. Having made many trials to obtain satisfactory news of patients who could be watched long enough after the operation, I have failed in collecting a sufficient number for a reliable statement. In every case of such excision on a subject below the age of puberty the ultimate value of the limb remains for some years doubtful.[1]

Three methods of operation may be named as the most advantageous—the first, by making an incision from the outside of the joint, commencing over the external lateral ligament, carried under the patella, and dividing the tendon, to the internal ligament. The incision must extend sufficiently far back to permit a depending opening for the exit of pus. The front and sides of the bones must be cleared of soft parts, the flap, including the muscles, and all textures between the skin and bones. With the upper one, the patella is reflected. Forcible flexion, carried until tibia and femur are nearly parallel, causes the ends of the bones to protrude from the wound. The second method of operating consists in making a longitudinal incision on either side of the joint, sufficiently far back to afford a depending outfall for pus, and connecting these by a transverse cut, carried from the middle of one to that of the other longitudinal incision below the patella, and dividing its ligament. The quadrilateral flaps thus formed are dissected from the bone, the patella being included in the upper one, and turned respectively upwards and downwards. Flexing the joint brings both femoral and tibial surfaces out of the wound, and the articular surfaces are to be removed with the saw. The third mode, advocated by Mr. Humphry, only differs from the former in making a crucial instead of an H-shaped incision. The further steps are precisely similar. Some doubt may be entertained whether the patella should be removed or left. Certainly its presence gives a more shapely aspect to the joint; but it is often the cause of subsequent annoyance. No question as to its removal can arise, if it be extensively diseased; but even when the amount of morbid action is confined to a small space, the balance of evidence appears to be rather in favor of its ablation. In sawing the necessary slice from the ends of the femur and tibia, care must be taken to make the section at a right angle to the axis of the bones, otherwise the leg will not be in a straight line with the thigh. The surface of the section must be very fully examined, and judgment formed concerning the probability of the case doing well, according to the principles already inculcated (p. 417). The wound is to be closed with sutures, except a portion at the back at either side, where the lips may be kept open by a fold of lint. It is not advisable to allow this part to heal by the first intention; it is wanted as an outfall for pus. The rest of the wound is to be kept together by strips of wet lint.

---

[1] One of Dr. Heusser's patients took with that gentleman, 9 months after the operation, an arduous walk, ascending a mountain 6500 ft. in height; he now presents his surgeon every year with chamois meat and alpine birds of his own killing; the operation was performed in 1851, and the result is given as complete synostosis.

Before the patient is removed from the table, a long, well-padded splint, provided with a foot-board, should be bandaged to the back of the limb; and when the patient is in bed, an outside Desault's splint, extending from the top of the ilium to the foot, is to be applied.

The great object in the after-treatment is to provide plentiful means for the flow of pus, and so to manage the dressings that the limb is not disturbed, thus giving the greatest possible chance for bony union. Mr. James Salter modified the swing cradle in a very clever manner, so as to hang the back splint upon a steel bar above the limb by means of a wheeled apparatus, so that the ordinary movements of the patient's body may not disturb the bones. Mr. Price has provided the splint at the back of the limb, which is constructed of tinned iron, with a means whereby it may be either lengthened or shortened; he also divides the outside splint into two, leaving a gap in the region of the knee, and connects these two portions together by a loop of iron. By this latter contrivance the wound is readily accessible, without any necessity for disturbing the limb by lifting or otherwise. The somewhat intricate arrangement offends against our partiality for simplicity; certainly the swing cradle allows an occasional alteration in position, so as to relieve the tedium of long confinement. Our cases at the Charing-Cross Hospital have been treated simply by a splint at the back and another at the outside of the limb, and we have never had the misfortune of having a single fatal case, of resorting to a secondary amputating, nor of turning out a single useless limb after excision; although some of the patients have been extremely restless.

It has been said that the splint is to be applied to the back of the limb before the patient is removed from the table; to that statement must be added that it should be applied before he is allowed to recover from the chloroform. I am, from my own observation, convinced that in most cases when the patient regains consciousness, there comes on a spasm of the flexor muscles which renders adjustment, if not already effected, very difficult, or perhaps impossible. Such obstacle has been encountered by some of our most able surgeons.

This operation has been performed for injury, gunshot or otherwise, for joint disease and for anchylosis. The removal of a wedge-shaped piece of bone from femur and tibia, united at an angle, permits their adjustment in a straight position. The operation is perfectly justifiable on a *full-grown* patient (see p. 399), when the leg is so far bent as to be useless or an incumbrance. The cases do better than excision for active disease. Mr. C. Heath showed, at the Pathological Society,[1] portions of bone removed from an anchylosed knee. The recovery was successful, though tedious, but so much had to be removed from the femur and tibia, that it is extremely doubtful whether growth will continue. The patient of Dr. Heusser's, who employs himself now in chamois-hunting, submitted to the operation on account of an anchylosis.

The operation must be considered as still *sub judice*. It has had zealous advocacy and bitter antagonism. At the present time the balance of evidence seems rather in its favor, but we have not all the evidence. It cannot be said either that preference should be given to excision or to amputation, but it may be observed that the choice of cases for excision of the knee should be very carefully made, and that it is not an operation which can be practised in an equal number of diseases of that joint, as resection of the elbow or shoulder, in maladies of those articulations.

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[1] "Pathological Transactions," vol. xi. p. 204: and "Lancet," 7th July, 1860.

CASES OF EXCISION OF THE KNEE.

CASE LXIV.—William King,[1] aged 33, had entered the Charing-Cross Hospital in order to suffer amputation of the thigh, having suffered for five years from diseased knee-joint.

May 14th, 1859. Mr. Hancock, determined to excise the joint, proceeded to operate by making an H-shaped incision over the joint. Much ill-concocted pus flowed away when the synovial cavity was opened. However, no difficulty occurred in flexing the joint and causing the bones to present at the wound, and rather thin slices were removed from both tibia and femur.[2] The surface of the section was examined with some care: the cancelli were filled with a pink granulation tissue, except in certain marbled lines, where their walls were thickened and their cavities almost obliterated by that action. There was one spot on the tibia where the bone was suppurating. A gouge was here applied, and the softened tissue of very little depth removed. The patella was taken away.

The wound was closed, except at the back, the limb adjusted, and placed on a straight splint, while the man was still insensible, without the slightest difficulty; he was taken to bed and a long Desault's splint fixed to the outer side of the thigh. He was ordered wine and strong broths; twenty minims of laudanum at night; cold water applied.

15th. The man has had very little constitutional disturbance, and hardly complains of pain.

18th. The soft parts round the wound are somewhat swollen; the edges a little red; sutures removed.

25th. The parts are suppurating freely, and granulations are formed, which slightly project beyond the surface, looking, however, perfectly healthy.

June 14th. There is evidently some soft union between the bones and the external wound, except a part at the back; in the middle of each, longitudinal incision has healed. The limb is very straight, and the man's health has greatly improved.

July 14th. The parts are very firm; he can lift the limb in the splint a little way from the bed, but is ordered not to do so.

This last date was during the ninth week; in the tenth the wound had entirely healed, and the part was inclosed in a dextrine bandage; he was allowed to get up and walk with crutches in the twelfth week.

Aug. 10th. He was able to walk with a stick, and was discharged, with shortening of about two inches; no sinus is open.

CASE LXV.—George Payne, aged 8, has suffered for four years with knee-joint disease. He is now, November, 1859, very weak and emaciated.

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[1] For the previous history of this case, see p. 162.

[2] For an account of the examination of parts removed, see p. 162.

An abscess extends nearly half way up the thigh, and another is beneath the gastrocnemius. Nevertheless, Mr. Hancock believed that excision afforded him a better chance than amputation, as producing less shock to the system.

January 7th. Mr. Hancock excised the knee-joint, removing thin slices from the bone, and taking away also the patella. A great deal of pus came from beneath the anterior and lateral femoral muscles; a splint was placed at the back of the limb and bandaged downwards on the thigh and upwards on the leg. He was taken to bed and an outside splint applied. Ordered wine and ten minims of the tincture of opium to-night.

8th. The boy has been frequently sick from the chloroform, but he passed a very fair night, and he does not appear the worse for the operation; has profuse discharge, but no pain. Continue the wine ordered every six hours.

℞. Mist. ammoniæ sesquicarbonatis efferves. ℥jss.
Acid. hydrocyan. dil. ♏iij. M.

10th. Vomiting has ceased, and he is stronger; has slept well. The discharge is profuse; the edges of the wound pale and flabby. Discontinue the effervescing draught. To take the following three times a day:—

℞. Quinæ disulphatis gr. ij.
Acidi sulphurici diluti ♏viij.
Spt. æth. chlorici ♏iij. M.

14th. The boy is better and more cheerful, but is still very feeble, and the discharge continues profuse.

21st. The boy is now very fretful, and his back is red and sore; the limb was fixed more completely in the splint, and he was turned over on the sound side.

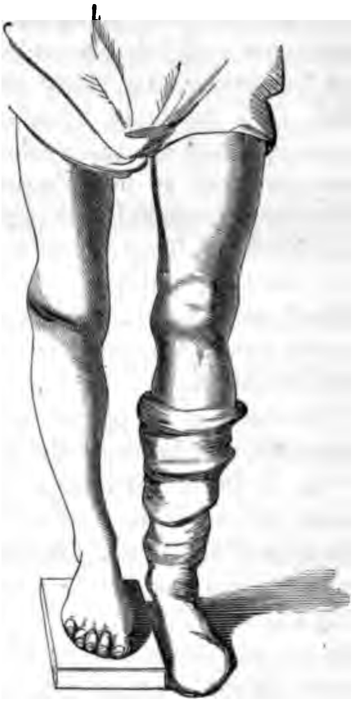
It is not necessary to follow out this case date by date: owing to the most assiduous care, bed-sores were prevented; he had to be turned one day on one side, next on another; the profuse discharge from the abscesses rendered it necessary to dress the wound every day for six weeks; but a little improvement at each visit still gave hopes, and in two months from the date of operation it became evident that some union was taking place. He still, however, required assiduous care. In the thirteenth week he could sit up, the discharge had very much diminished, and his appetite was exceedingly good.

It was five months after the operation before he was allowed to get out of bed, the limb being well guarded by a dextrine bandage, outside of which was a pasteboard splint. Ultimately the union became quite solid, and he could walk with only a stick. He was discharged eight and a half months afterwards with a sound limb.

This boy would, I think, hardly have survived the shock of an amputation high up in the thigh. The perfect soundness of all the viscera was established by the careful examinations of Dr. Willshire and Dr. Salter. These and the event justified the operation.

CASE LXVI.—A man (Castles), from whom the annexed figure is taken, is now (November, 1860) in the Charing-Cross Hospital, whose knee-joint Mr. Hancock removed in March, 1858. During recovery he had two attacks of inflammation, ending in abscesses, one inside, the other outside the uniting-bones. However, in the thirteenth week the wound was healed: at the end of the fifth month he was discharged. He has been working as a gardener since, and found the stiff limb extremely useful in driving down the spade. Eight months ago he had an attack of pain, which caused him to take to his bed. In ten days this ceased, and he went to work again, but in six weeks more pain returned, and has been coming back at shorter and shorter intervals. Rest after a time did not suffice to still them. He returned under Mr. Hancock's care 5th May, 1860, complaining of these recurrent pains. There was a sinus both inside and outside the new union. The influence of counter-irritants, of rest, and a diet better than what he had been accustomed to was tried, and for four months he appeared getting better. However, pain returned. On examining the sinuses they were found to extend through the thickness of the limb, but no rough bone could be felt.

Fig. 32.



Excision of the knee. (Two years after operation.)

November 23d. It was thought advisable to cut down and find out what was the condition of parts. The mass of tissue which formed the scar at the outside of the limb was very thick and tough; the finger entering into the wound at this place passed behind the lower end of the femur, which could be felt firmly united to the anterior part of the sawn surface of the tibia; the posterior portion of this surface was bare, rough, and carious. The gouge was freely applied, and all that could be felt diseased removed.

Up to the 14th December the man has been going on well, and promises to recover soundly.

Excision of the ankle joint was first performed by Moreau in 1802, and although, from what I have seen of it, I am inclined to consider that it furnishes as favorable results as such operation upon any joint, it has not found great favor in England. This, perhaps, may be attributed to the unfavorable opinion given of it by Mr. Syme,[1] or to the somewhat complicated nature of the operation. The idea that synostosis of the two bones (tibia and astragalus) would render the foot nearly useless, is a mistake, and is not founded on experience (Mr. Syme had never performed or seen a case of such an operation), for the tarsal joints become so flexible as to compensate for this defect, more especially in the case of a child, and the amount of shortening is so small, that, when the person has a slightly elevated heel, lameness is hardly detectable.[1]

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[1] "On Excision of Diseased Joints."

I can gather only thirty cases of this operation, five proving fatal. The mortality, therefore, if we may deduce a percental reckoning from so small a number, is 16.66. Of four cases which have occurred at the Charing-Cross Hospital, one died.[2] The other three recovered, with perfect synostosis, and yet a sufficiently movable foot. They would not have been able to run or to leap very actively; but one of them (a man, aged thirty-two) has walked, ten months after the operation, several miles every day, at a rapid pace. The other two are, from what I hear, in an equally good condition.

The object of the operation is to cut off the upper surface of the astragalus, and lower of the tibia, without dividing any tendons, nerves, or important vessels. The foot is first laid on its inside, and an incision is made over the lower three inches of the posterior edge of the fibula. When it has reached the lower end of the malleolus, it forms an angle, and runs forward and downward to within about half an inch of the base of the outer metatarsal bone. The angular flap is reflected forwards; the fibula, about two inches above the malleolus, is sufficiently cleared of soft parts to allow cutting forceps to be placed over it; and the bone is then nipped in two, and carefully dissected out, leaving the peroneus longus and brevis tendon uncut. The foot is now to be turned over. A similar incision is made as on the inner side, the portion on the foot terminating over the projection of the inner cuneiform bone. The flap is to be turned back, and the sheaths of the flexor digitorum and posterior tibial tendons divided, the knife being kept close to the bone, avoiding the artery and nerve. The internal lateral ligament is then to be severed carefully, close to the bone; and now the foot is twisted outwards, and the astragalus and tibia will present at the inner wound; a narrow-bladed saw, put in between the tendons into the inner wound, projects through the outer. The lower end of the tibia, then the top of the astragalus, may be sawn off in a proper direction. The only vessel that may require tying is one of the lowest branches of the peroneal artery.

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[1] A drawing which was made for me on the wood from one of these patients presents so little alteration from the normal that I was advised not to have it cut.

[2] This was a woman in whom both strumous and syphilitic disease were advanced—when she could put her foot to the ground, she was sent into the country, and in a few months fell a victim to phthisis.

The wound may be closed with sutures, except that part opposite the breach of osseous matter; the leg and foot placed on a splint with a footboard; and cold water applied. No shock follows the operation. The patients get well very quickly, a fact which may be in part attributed to there being no necessity for rigid confinement, as in other large joints of the lower extremity.

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